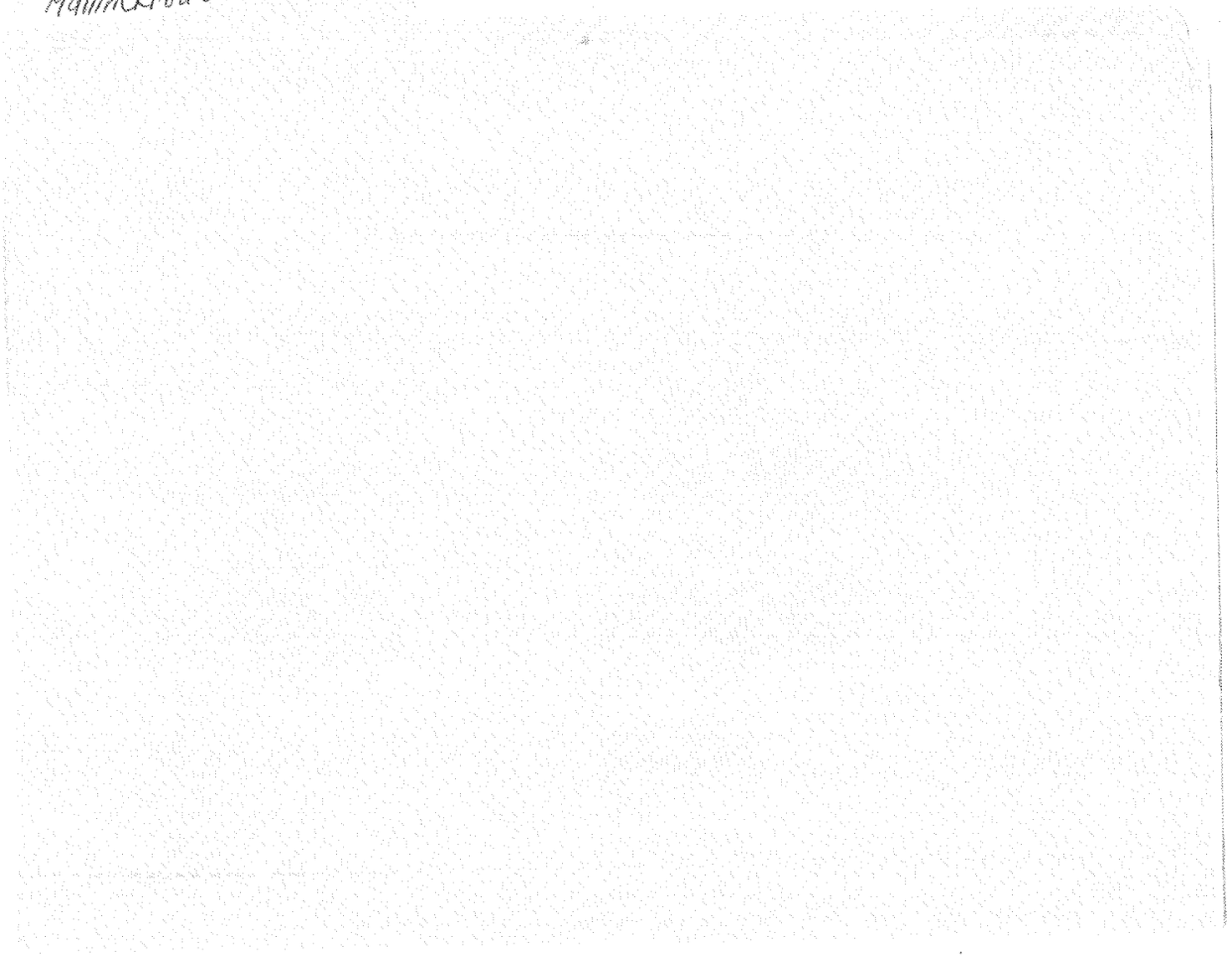
Mallinckrodt



ENVIRONMENTAL C
DEPARTMENT

Selected Materials

April 1, 1991

TO: Roger Wieting
John Koeper

FR: Bernard A. Rains

RE: ANGELICA ASH PILE TESTING

IT'S YOUR PROBLEM NOW

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Our Department's Account No. 133 for Fiscal Year 1990 contained $111,000. Six District properties were budgeted at $46,500 for environmental assessments with the remaining $64,500 allotted for the Angelica Ash Pile Testing Program. This latter amount was based on previous estimates obtained from preliminary discussions with two companies involved in radiological testing.

Unfortunately, during the Phase 1 property assessment study, O'Brien & Gere uncovered problems that required Phase 2 studies for 4 of the properties which amounted to another $20,800. We only have about $43,700 left in Account No. 133 for the Angelica Ash Testing.

As you know, we selected TMA/Eberline as the most qualified firm to evaluate our Angelica ash. They were requested to prepare a cost estimate for the proposed radiological study. Their first estimate was $282,663. I indicated the unacceptability of this estimate and they re-evaluated the work with a reduced scope and submitted a second estimate of $155,594.56. I told them this was also unacceptable and indicated to them we would begin negotiations with the second qualified firm, Engineering-Science.

Enclosed is a copy of the cost estimate from Engineering-Science in the amount of **$86,480.00.** I don't believe we can get the project completed for any less than this amount. But as you can see my Account No. 133 is short $42,780. In order for us to enter into a contract with Engineering-Science we will need this amount from another account. After you have reviewed the cost estimate from Engineering Science, please advise me on what action we should take.

BAR

kat

Enclosures
pc Jim Byrne

MEMO TO: John Koeper

FROM: Roger Wieting

SUBJ: Bissell Incinerator ASh

DATE: February 9, 1987

In June of 1986 the enclosed ordinance was adopted to haul incinerator ash that was previously stockpiled on Angelica. In January of 1987 bids were received to complete the work. Thomas was the apparent low bidder (90,000 cubic yards at $1.20 per cubic yard - $108,000). Because of the court ruling, the bid has not beenawarded.

Next years budget contains $140,000 to clean and haul ash from the south ash basin at Bissell. This work must be completed to provide space for disposal of ash. The money was left in the 1987-88 budget but could be removed if the money from Ordiance 6618 is used.

During the meeting of February 6, discussion was held about using money from Ordinance 6618 to clean the south ash basin and possibly a portion of the Angelica ash. After Thomas cleaned the North basin we verbally asked for a price to clean Angelica. Because of problems with Thomas' subcontractors and a delay of time, we rebid hauling the Angelica ash. I am hesitant to go back to Thomas for a change at this time if we are not definite about completing the work.

After reading Ordinance 6618 and considering the above, should I contact Thomas about cleaning the south basin using the money from Ordinance 6618? The $197,000 remaining in this account ($8,000 spent to complete the North basin) will certainly clean the south basin and even a portion of Angelica.

RW:lt

O R D I N A N C E NO. 6618

AN ORDINANCE, appropriating Two Hundred Five Thousand Dollars ($205,000.00) from the General Fund of the District to the Wastewater Department for the hauling of ash that has previously been stockpiled at the Bissell Point Wastewater Treatment Plant.

BE IT ORDAINED BY THE BOARD OF TRUSTEES OF THE METROPOLITAN ST. LOUIS SEWER DISTRICT:

Section One. The sum of Two Hundred Five Thousand Dollars ($205,000.00) is hereby appropriated from the General Fund of the District to the Wastewater Department for the hauling of ash that has previously been stockpiled at the Bissell Point Wastewater Treatment Plant.

Section Two. This ordinance, being an appropriation ordinance, shall take effect immediately upon its enactment.

The foregoing Ordinance was adopted June 25, 1986.

Mallinckrodt, Inc.

675 BROWN RD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) ~~895-6129~~ 895-2000 895-2703

October 23, 1980

DHK 10/27/80

Mr. Bernard A. Rains, Manager
Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 E. Grand
St. Louis, MO 63147

Dear Bernie:

As you know, Mallinckrodt manufactures Columbium and Tantalum salts at its St. Louis Plant. The ores used in this process characteristically contain small amounts of Uranium and Thorium and their respective daughters. Because of the concentrations of Uranium and Thorium in these ores, Mallinckrodt is required to hold a "Source Material" license from the Nuclear Regulatory Commission and to comply with certain NRC regulations.

In the past, Mallinckrodt disposed of most of the waste products from the C-T operation, including low levels of residual radioactivity, by discharging them into the sewer. This was done in compliance with our license and pertinent NRC regulations (10 CFR, ¶20.303). In recent months, however, Mallinckrodt became concerned about the impact of its discharges on the incinerator ash generated at the Bissell Point Plant of the MSD. Our concern focused on the accumulation of $Radium_{226}$ in the ash. Recent regulations proposed by the EPA and adopted by the Missouri Department of Natural Resources had established a limit of 5 pCi per gram of $Radium_{226}$ as a concentration above which there might be some adverse impacts on human health or the environment. Mallinckrodt had learned that MSD was considering sale of the ash for use in the manufacture of cement. We had estimated the contribution of discharges from the C-T operations to the $Radium_{226}$ concentration in the ash, and it appeared the discharges might result in levels greater than 5 pCi per gram of $Radium_{226}$.

Because of its concern regarding $Radium_{226}$ concentrations in the Bissell Point ash, Mallinckrodt discontinued its discharge of unreacted ore (URO) from the C-T operation to the sewer in July, 1980. At the same time, we retained NUS Corp., Rockville, Maryland, to provide a radiological assessment of the impact of

our discharges on the Bissell Point Plant. This assessment was conducted with the cooperation of yourself and other MSD personnel, and it was directed by Dr. Morton I. Goldman of NUS. This letter summarizes the data and conclusions of NUS Corp. that we believe are of interest to MSD. Mallinckrodt and NUS expressly disclaim any liability for actions that MSD may take on the basis of the information set forth herein.

NUS' assessment concentrated on the accumulation of Radium-226 in three piles of incinerator ash generated by MSD over the past decade. The first quantity of ash had been relocated from the Bissell Point Plant to a landfill on Hall Street in 1973. The second quantity of ash was accumulated between 1973 and March, 1977 and was relocated to a site on Angelica Street. The third quantity of ash was accumulated between March, 1977 and January, 1980; it is still held in ash pond number 2. This summary presents the results of various radiological assessments of each of these three piles:

A. Hall Street Landfill

1. Gamma Survey

NUS conducted a surface gamma dose rate survey at the Hall St. landfill over the area reported to be the site of the ash disposal. An Eberline PRM-7 "Micro-R Meter" was used, and measurements were performed at 100 foot centers over the area. Approximately 75% of the surface had gamma emissions near background (7.8 $\pm$ 1.4 μr/hr). 25% of the surface had measurements measuring between background and the maximum observed for the pile. These averaged 13.3 $\pm$ 1.8 μr/hr. The highest dose rate that was measured was 20 μr/hr., and this was measured in a location where the original ash appeared to be exposed. All other parts of the landfill seemed to have been covered with construction debris. The results of this survey are summarized in Figure 1.

The relatively low surface gamma measurements indicate there is no significant radiological hazard to persons working on or near the landfill.

2. Radon Emanation

There was no information available that would permit an estimate of the Radium-226 concentration in the Hall St. ash pile. Further, there was no information regarding the pattern and sequence of filling operations, the depth of ash, fill at any given area, and the thickness of cover. NUS was therefore unable to assess the potential radiological significance of the Hall St. landfill. NUS believed, however, if it were planned to construct buildings

on this site in the future, that a detailed investigation of the radioactive concentrations in the underlying material would be warranted.

B. Angelica Street Pile

1. Gamma Survey

Surface gamma dose rates were measured at 50 foot centers on the surface of the Angelica St. pile using an Eberline PRM-7 "Micro-R Meter". The average of 129 measurements was 19.7 ± 3.4 μr/hr., and the pile was found to be very uniform with regard to gamma emissions.

This dose rate compares with a whole body dose rate of about 15.7 μr/hr. estimated on the basis of the $Radium_{226}$ concentration analyzed in the pile. The latter number would result in a whole body dose of about 137 mr per year for a person exposed to the pile 24 hrs. per day, 365 days per year. This is obviously a conservative assessment of personnel exposure, but it indicates there is no significant radiological hazard, since the current limit for unrestricted areas is 500 mr per calendar year (10 CFR 20.105(a)).

2. Radon Emanation

NUS analyzed 14 samples of ash that were collected by MSD during the relocation of the Angelica St. pile. These samples were composited, and the composite was analyzed by gamma spectrometry using a GeLi crystal, with the following results:

Ra-226	-	8.7 ± 1.9 pCi/gram
Pb-214	-	7.7 ± 1.4 pCi/gram
Bi-214	-	6.6 ± 1.0 pCi/gram

This composite was also analyzed by Eberline using the Radon emanation method that is a standard method contained in the Missouri Hazardous Waste Management regulations (10 CSR 25-4, Appendix VI). That analysis was 8.9 ± 2.7 pCi/gram.

Based on the measured $Radium_{226}$ concentration, NUS estimated the Radon exhalation from the Angelica St. pile. A diffusion model similar to that used to analyze Uranium mill tailings was employed. The various physical parameters were estimated based on the experience of Dr. Goldman. A Radon flux of

about 1.1 pCi/m^2-sec. was estimated. This number is well within the normal range of the Radon flux found above U.S. soils. NUS concluded that no radiological significance could be attributed to Radon emanations from this pile in its present location.

3. Radon Emanation - Ash Recycle

NUS examined the question of use of the Angelica St. ash in concrete or concrete products. For this purpose, a model room 12 ft. x 15 ft. x 8 ft. was assumed to be walled with concrete block containing the Angelica St. ash. One air change per hour was assumed, which is a minimum proposed by the EPA for the control of indoor pollutants, and various other physical parameters were assumed based on Dr. Goldman's experience. If the concrete block contained 5 pCi/gram of $Radium_{226}$, it would contribute an incremental concentration of 380 pCi/m^3 of Radon to the interior of the room. When added to an assumed background level of 125 pCi/m^3 of Radon, a total indoor concentration of about 505 pCi/m^3 was estimated. This is in the medium range of "normal" indoor exposure. On this basis, NUS concluded that ash containing 8.7 pCi/gram should be acceptable for use in the manufacture of concrete products, assuming that this use would not exceed 1/3 to 1/2 of the final product weight.

C. Bissell Point Ash

1. Gamma Survey

Surface gamma dose rate measurements were performed on 27 foot centers using the Eberline PRM-7 portable "Micro-R Meter." The surface readings varied from 16 μr/hr. to 39 μr/hr., indicating a relatively heterogeneous pile. The results of the survey are summarized in Figure 2.

Depth profiles were also attempted at three locations on the pile. These measurements were made with an Eberline PRM-5-3, pulse rate meter, and a SPA-3, 2-inch x 2-inch NaI(Tl) scintillation probe. These measurements were not particularly useful because of difficulties with the equipment and collapse of the auger holes. However, it was noted that the gamma activity varied by a factor of 2 over the entire depth of two of the holes and by a factor of 1.5 in the third hole. These variations suggest that $Radium_{226}$ was deposited in the ash in a relatively

homogeneous manner. It had been speculated that the Radium$_{226}$ might accumulate in "lenses" or "pockets" of the ash.

NUS calculated a gamma dose rate at one meter above the surface of the Bissell Point pond of about 32 μr/hr. This was based on a conservative estimate of the Radium$_{226}$ concentration in the pile, and it agrees with the actual surface measurements noted above. This dose rate would result in an annual dosage of 284 mr, again assuming 24 hrs. per day, 365 days per year occupancy. NUS concluded that this poses no immediate concern with direct radiation exposure at the Bissell Point pond since there has been no significant amount of time spent over the pond by either employees of the plant or members of the general public. NUS recommended, however, that when the material is relocated, several feet of earth cover be placed over it to reduce the dose rate by about an order of magnitude.

2. Radon Emanation

Four pairs of samples of the Bissell Point pond were taken August 20, 1980. Due to the exposed surface available for sampling, these are heavily weighted to the latter months of discharge into this pond. These samples were composited, and the composite was analyzed by gamma spectrometry, with the following results:

Ra-226	-	9.9 $\pm$ 1.4 pCi/gram
Pb-214	-	7.8 $\pm$ 0.5 pCi/gram
Bi-214	-	8.8 $\pm$ 0.6 pCi/gram

The same composite was analyzed by Eberline using the Radon emanation method. Their analysis indicated 6.9 $\pm$ 2.7 pCi/gram Radium$_{226}$.

NUS did not use these measured concentrations of Radium$_{226}$ to estimate the Radon emanation from the Bissell Point pond. Instead, NUS calculated the Radon emanation based on a model that assumed a thin contaminated ash layer beneath an overlying ash layer of increasing thickness, each thickness representing a three month increment of time. Using this model and diffusion characteristics similar to those of the "wet beach" portion of the Uranium mill tailings pond, NUS calculated that the lowest Radon flux (6,300 pCi/sec.) occurred during the fourth

quarter of 1978 and the highest (44,000 pCi/sec.) during the fourth quarter of 1977. The highest average annual flux occurred during 1979 and was 29,300 pCi/sec. or 1.9 pCi/m^2-sec.

This latter number is below the limit proposed by the NRC for stabilized mill tailings. NUS estimated that this emission rate would not result in more than about a 1% addition to the average Radon background within a few hundred yards of the Bissell Point pond. This is well within the normal range of variation in natural Radon background values. NUS did note, however, that this analysis was based on an assumption of relatively moist ash. NUS recommended that attention be paid to the potential for Radon exhalation into structures that might be built over the ash if it were moved to a less controlled environment such as a landfill. Further, if the ash is relocated, this should be accomplished on a wetted basis to minimize dusting.

3. Radon Emanation - Ash Recycle

Since NUS was concerned that the measured $Radium_{226}$ concentration might not be representative of the entire Bissell Point pond, a calculated level of 18 pCi/gram $Radium_{226}$ was used for an assessment of the impact of ash recycle. This number was calculated based on the inclusive dates of collection of ash from the Bissell Point pond and a knowledge of discharges from Mallinckrodt during that time period.

Using the same model described above, NUS concluded that ash from the Bissell Point pond could be used in the production of cement products provided the ash was diluted sufficiently to keep the total $Radium_{226}$ in the final cement product below 5 pCi/gram. If the ash contains 18 pCi/gram $Radium_{226}$, and if other constituents in the cement contain, say, 1 pCi/gram $Radium_{226}$, then the fraction of ash in the total cement product should be less than 25%.

Alternatively, NUS suggested that the product might be restricted to uses (such as road construction) which are less constraining than potential residential use. Of course, if further sampling confirms the lower concentration of about 10 pCi/gram $Radium_{226}$ in the Bissell Point pond, there would be less concern regarding use of the ash in cement products.

D. Additional Analytical Results

1. Current Ash

A sample was taken on July 31, 1980 from ash pond #1. At the time this was thought to be representative of current ash; it should therefore reflect the discontinued discharge of URO wastes from Mallinckrodt's St. Louis Plant. This sample was analyzed by gamma spectrometry, with the following results:

Ra-226	-	9.3 ± 5.0 pCi/gram
Pb-214	-	9.8 ± 1.4 pCi/gram
Bi-214	-	7.5 ± 3.0 pCi/gram

MSD, however, has expressed uncertainly that the sample truly represented current ash production. Another sample of current ash was therefore collected on August 18, 1980. This sample was collected from the filter cake being discharged to the incinerators, and it was incinerated in the Bissell Point laboratory. It too was analyzed by gamma spectrometry, with the following results:

Ra-226	-	7.0 ± 2.6 pCi/gram
Pb-214	-	3.8 ± 0.4 pCi/gram
Bi-214	-	3.2 ± 0.7 pCi/gram

This sample was also analyzed by Eberline using the Radon emanation standard method. Their analysis was 3.2 ± 1.0 pCi/gram $Radium_{226}$. This corresponds more closely to the daughter product concentrations analyzed by NUS. This concentration of about 3.2 pCi/gram $Radium_{226}$ appears to be representative of the current ash.

2. Current Grit

A sample from the grit collector was taken July 31, 1980. It was analyzed by gamma spectrometry, with the following results:

Ra-226	-	1.8 ± 1.0 pCi/gram
Pb-214	-	1.2 ± 0.3 pCi/gram
Bi-214	-	1.4 ± 0.5 pCi/gram

NUS has informed Mallinckrodt that the company's discharge of radioactive residues from the C-T operations appears to have been in compliance with applicable NRC regulations. Moreover, NUS has detected no significant radiological threat to human health or the environment from those discharges. It is accordingly Mallinckrodt's view that the company could safely resume discharge

of URO from the C-T operation into the MSD sewer and that such discharge would continue to be in compliance with NRC requirements. Mallinckrodt, however, does not intend to resume discharge of URO without first consulting with MSD. Moreover, the company is prepared to work to minimize the discharge of $Radium_{226}$ in any subsequent resumption.

Mallinckrodt wishes to express its appreciation for the cooperation of MSD in permitting NUS to sample ash and to conduct certain surveys at MSD facilities. Mallinckrodt is providing this summary of NUS' findings, insofar as they pertain to MSD, as agreed. Mallinckrodt is providing this information, however, solely for MSD's general information, and neither Mallinckrodt nor NUS can or does make any warranties or representations concerning the accuracy or completeness of the information for MSD's purposes.

Very truly yours,

MALLINCKRODT, INC.

S. N. Robinson
Director
Environmental Affairs

SNR
ds

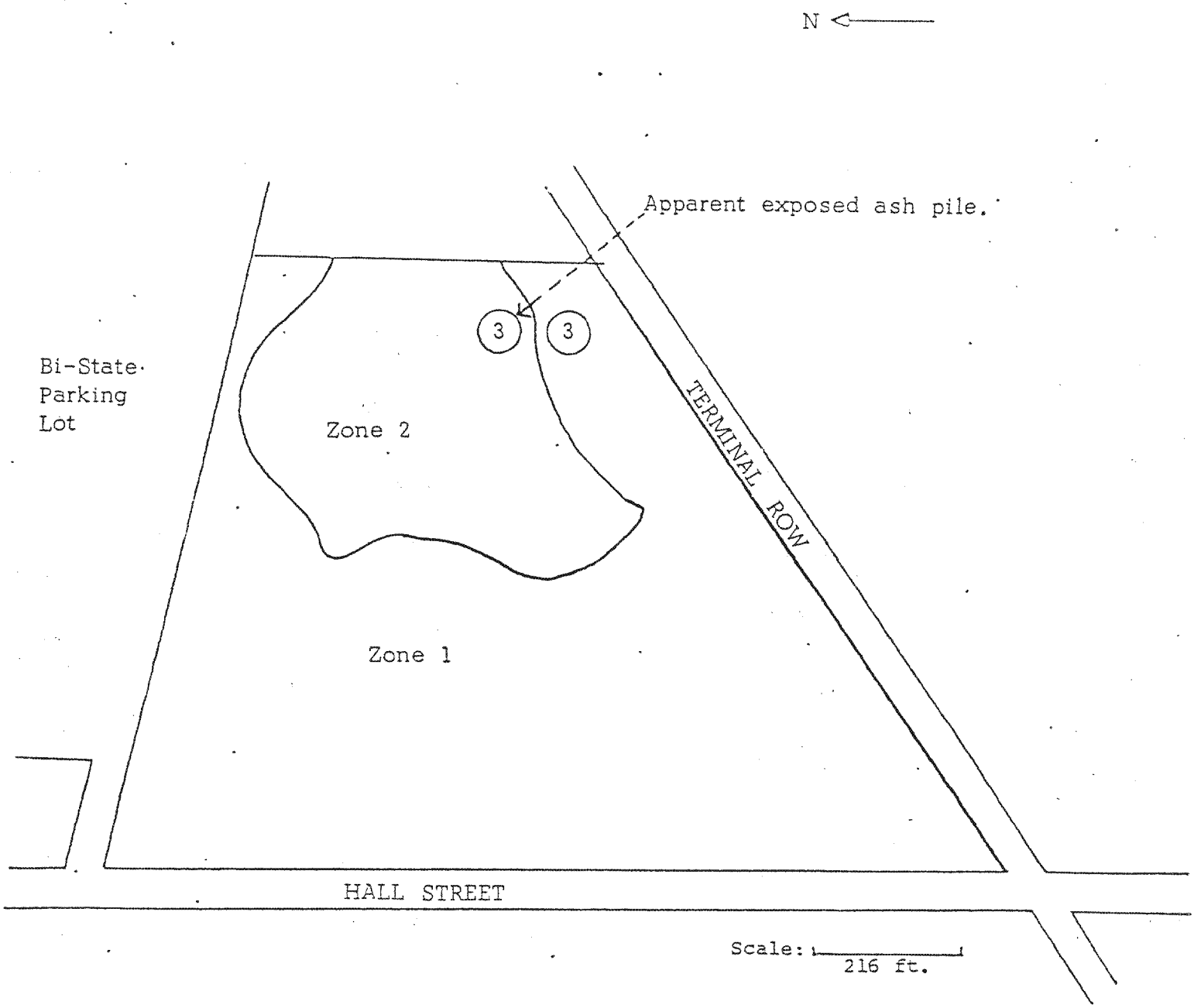

Figure 1. Results of Surface Dose Rate Survey at Hall Street Ash Disposal Site

Zone 1 = 7.8 ± 1.4 μr/hr.
Zone 2 = 13.3 ± 1.8 μr/hr.
Zone 3 = 20.0 μr/hr.

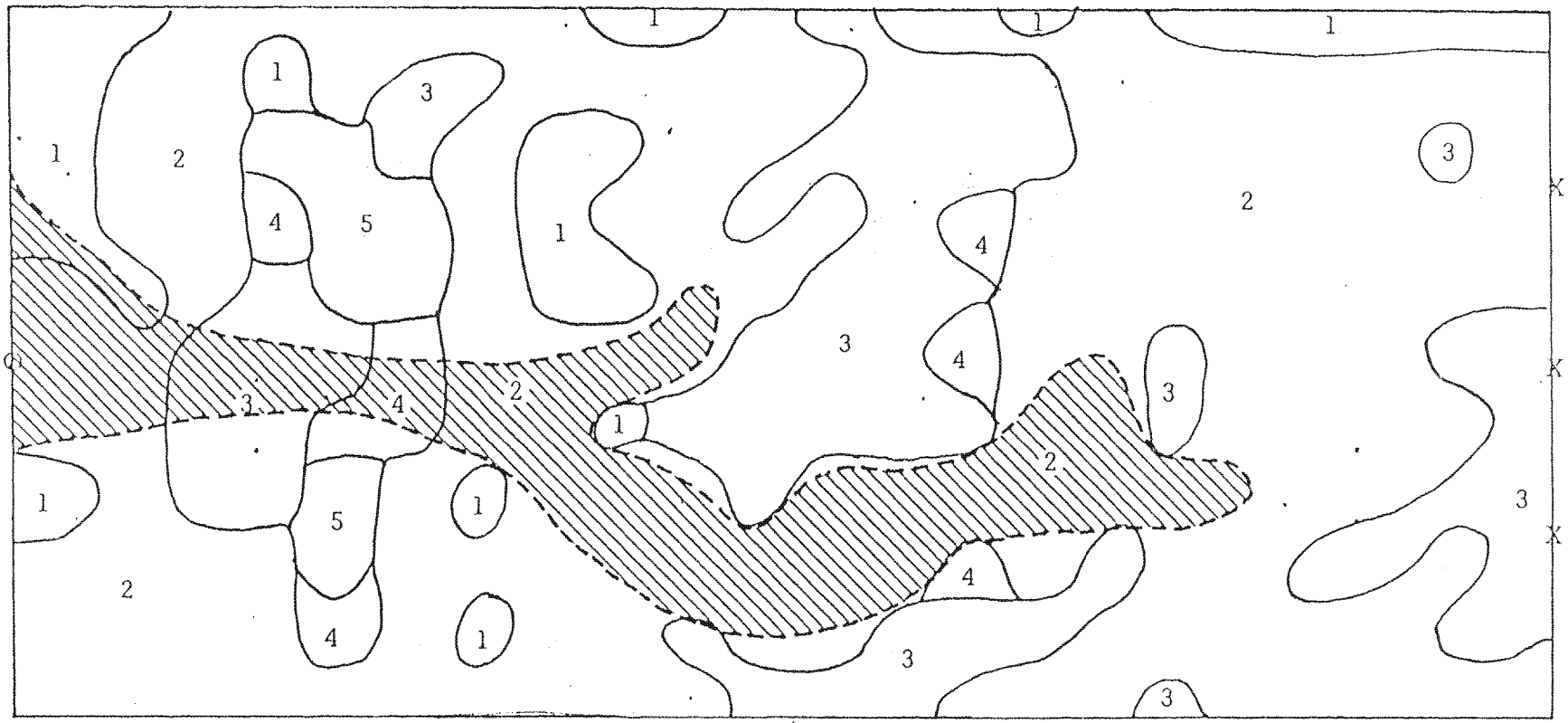

Figure 2. Results of Surface Dose Rate Survey at Bissell Point Sewage Treatment Plant

Zone 1 <20 μr/hr; Zone 2 = 20 to 24 μr/hr;
Zone 3 = 25 to 29 μr/hr; Zone 4 = 30 to 34 μr/hr;
Zone 5 = 35 to 39 μr/hr.

X's are input points; O is outfall.
Cross-hatched area indicates ravine caused by pond drainage.

Mallinckrodt, Inc.

675 McDONNELL BLVD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-2000

March 25, 1982

Mr. Charles B. Kaiser, Jr.
Acting Executive Director
Metropolitan St. Louis Sewer District
200 Hampton Avenue
St. Louis, Missouri 63139

Dear Mr. Kaiser:

On several occasions during the past few months representatives of Mallinckrodt, Inc. (Mallinckrodt) and the Metropolitan St. Louis Sewer District (MSD) have held discussions regarding a proposed surcharge billing to be submitted to Mallinckrodt for consultant's fees, staff-related expenses and other expenses related to the disposal of incinerator ash by MSD. As you know, Mallinckrodt has not accepted liability for those fees and expenses.

Nevertheless, rather than litigate or arbitrate this dispute Mallinckrodt agrees to pay MSD $61,916.00. In return MSD agrees that this payment shall not serve as a precedent for any future requests for payment of this nature to Mallinckrodt. Furthermore, MSD agrees that this payment does not represent an admission of liability on Mallinckrodt's part for the work that MSD had performed and for which it billed Mallinckrodt.

Should this letter accurately reflect the resolution of this matter as you understand it, please indicate your agreement by signing and returning this letter.

MALLINCKRODT, INC.

By Mack G Nichols
Mack G. Nichols
Vice President

AGREED:

METROPOLITAN ST. LOUIS
SEWER DISTRICT

By Charles B Kaiser, Jr.
Charles B. Kaiser, Jr.
Acting Executive Director

cc: Roger Wieting
Bernie Rains

Mallinckrodt®
LEGAL DIVISION

MEMO TO: Bernie Rains

FROM: Roger Wieting RW 12/18/81

SUBJ: Bissell Ash Hauling

DATE: December 18, 1981

During November of 1981, the District opened sealed bids to haul 80,000 cubic yards of incinerator ash from the Bissell Point Treatment Plant. The lowest bidder was Schaefer-Meyer-Baughman at a total cost of $266,400 ($3.23/ cubic yard plus $8,000 mobilization costs). The second lowest bidder was John Washington at a total cost of $301,200 ($3.75/cubic yard plus $1,200 mobilization costs). This bid was later withdrawn. The third lowest bid was Thomas Hauling Co. at a total cost of $346,800 ($4.21 per cubic yard plus $10,000 mobilization costs). A complete list of bids is enclosed.

The ash to be hauled from basin #2 contained 5.4 p Ci/g of Ra-226. Because of this characteristic, District officals carefully weighed the ultimate disposal site. It was decided to award the contract to Thomas Hauling Co. for disposal at Rock Hill Quarry.

Since wastes from Mallinckrodt Chemical Co. caused the elevated levels of Ra-226, they should defray the additional hauling costs of $80,400.

The District has 61,000 cubic yards of ash containing 5.8 p Ci/g of Ra-226 stored on Angelica. This material may also require special handling costs. This cost is not known at this time but may range from $61,000 to $122,000 ($1 to $2 per cubic yard).

Hopefully the ash in basin #1 will be below 5 p Ci/g. However, material received during dumps from Mallinckrodt in November, 1981 may also adversly affect the contents of this basin.

RW:lt

Encl

Summary

Ash Bid-No. 57

	Contractor	Mobilization	Per Yard	Total @ 80,000	Landfill
1.	Schaefer-Meyer-B	8,000	3.23	266,400	Pilsberry
2.	John Washington	1,200	3.75	301,200	Hall Street
3.	Thomas	10,000	4.21	346,800	Rock Hill
4.	Unnerstall	6,500	4.85	394,500	Rock Hill
5.	Schaefer-Meyer-B	8,000	5.20	424,000	SCA
6.	Schaefer-Meyer-B	8,000	5.69	463,200	Rock Hill
7.	McCarthy Brothers	10,000	5.81	474,800	Rock Hill
8.	Trans-Truck	1,500	5.98	479,900	Rock Hill
9.	C. Spight	800	6.49	520,000	Rock Hill
10.	Casper	9,500	6.40	521,500	Rock Hill
11.	Bayless	9,700	6.43	524,100	Rock Hill
12.	Krupp & Kirkwood	15,000	7.50	615,000	Rock Hill
13.	Kozeny-Wagner	2,410	8.05	646,410	Rock Hill

July 29, 1981

Mr. Bernard Rains
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand Ave.
St. Louis, MO 63147

BR 8/3/81

Dear Bernie,

At a July 21 meeting with the MSD staff, myself, and Mr. F.L. Bronson, CHP, Vice President of RMC, we reviewed the various disposal options of the Bissell Point ash. The following points represent our recommendations relative to the disposal of the ash at a commercial landfill.

1) To the best of our knowledge, this disposal will not violate any federal or state regulations. This is due to the fact that the type and concentrations of radioactivity in the ash is such that the material is not defined as "radioactive", for purposes of regulatory control.

2) In RMC's opinion, such disposal will not present a significant radiological hazard now, or in the future, to the environment or the population. This assumes that the material is dispersed throughout the fill, or that it is buried at least 10 feet below the ultimate surface of the fill. We also assume that future construction of residential structures over this fill is highly unlikely.

3) Placement in a landfill results in disposal in a relatively controlled manner. Site selection studies of site characteristics are usually sufficient to confirm that material will not move off the site. Also, it is unlikely that the fill will be disturbed (via drilling or excavation) in the future.

4) Disposal at active landfills is such that further dilution of the ash with other fill materials will occur. This assumes that transfer of the ash is spread out over a period of several weeks (or months) so that large quantities of other material is added between loads of ash. Since each load is normally pushed, spread and/or leveled by the fill operator, natural dispersion would occur.

radiation management corporation

3508 MARKET STREET
PHILADELPHIA, PA 19104
(215) 243-2950

Each of the above points makes disposal of the ash in a landfill an attractive option. However, RMC must identify potential problems with this course of action.

The first is a natural aversion of the landfill operator, and of local governments and residents, to accept any material containing radioactivity, regardless of technical definitions of "radioactivity", or of the innocuous nature of the material.

The second relates to proposed EPA rulemaking which would define material in excess of 5 pCi/g Ra-226 content as hazardous material. Should this occur, MSD could be responsible for demonstrating that material it released was below this guideline. If the assumed dilution described in 4) above did not occur, or could not be satisfactorily demonstrated, MSD could be liable for possible remedial actions, such as recovery of the ash.

While RMC does not consider the problems sufficient to preclude the proposed disposal, MSD should carefully weigh the costs and potential liability for these actions before pursuing the landfill disposal option.

If you have any questions, or require further assistance, please call this office.

Sincerely,

Lee Booth

Leroy F. Booth, C.H.P.
Manager, Midwest Regional Office

LFB:kgc

cc: F.L. Bronson, RMC

rmc

2/12/81

February 6, 1981

Mr. Bernard Rains
Metropolitan St. Louis Sewer District
10 East Grand
St. Louis, Missouri 63147

Dear Bernie,

Enclosed are three (3) copies of our report on the first phase of the Bissell Point incinerator ash Radium 226 project.

If there are any questions, please call this office.

Sincerely,

Lee Booth

Leroy F. Booth, C.H.P.
Manager, Midwest Regional Office

Enclosure: Report, three copies-Bissell Point incinerator project

cc: F. Bronson, RMC.

LFB:sn

radiation management corporation

Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062
(312) 291-1030

Radiation Management Corporation

Midwest Division 3356 Commercial Avenue
Northbrook, IL 60062
(312) 291-1030

REPORT ON RADIUM CONTAMINATION OF

BISSELL POINT INCINERATOR ASH

Prepared for:

Metropolitan St. Louis Sewer District

Prepared by:

Radiation Management Corporation

TABLE OF CONTENTS

INTRODUCTION

I. INTRODUCTION

In September, 1980, Metropolitan St. Louis Sewer District (MSD) requested assistance from Radiation Managment Corporation (RMC) concerning a potential radiological problem associated with certain treatment plant operations. Specifically, MSD was concerned about possibly elevated Ra-226 levels in incinerator ash generated at the MSD Bissell Point Sewage Treatment Plant.

This ash is generated at the MSD treatment plants by incinerating sewage sludge, and is then stored in ash settling basins on site. When the settling basins reach capacity, the ash must be relocated and/or disposed of. In the past, the Bissell Point ash has been relocated at two off site location; the Stein Dump on Hall Street and the MSD property on Angelica Street.

In an effort to relieve this disposal problem, MSD, in early 1980, reached tentative agreement to sell the ash to an industrial manufacturer. This contractor proposed to use the ash in the production of cement, thereby saving MSD significant disposal costs. Since the ash had already been analyzed for characteristics defined as hazardous by the EPA, and found to be within applicable limits, there seemed to be no problem with the proposed sale.

Following announcement of this proposed use of incinerator ash, MSD was notified by one of their system users that they (MSD) should analyze the ash for radioactivity, specifically Radium-226. The reason for this recommendation was that the user (Mallinckrodt, Inc.) had routinely been

releasing materials containing elevated levels of Ra-226 to the sewer and there was concern that the ash might contain levels which would preclude commercial use. In addition, Mallinckrodt indicated they had employed a consultant, NUS Corporation, to analyze the Ra-226 content in the ash and to assess the potential hazards related to the proposed use of this ash.

At this point, MSD requested RMC to provide several consuting services. Specifically, these included:

a) A review of all applicable regulations pertaining to disposal of low-level radioactivity.
b) Independent analysis of various samples submitted by MSD, with respect to Ra-226 content.
c) Comparison with and evaluation of NUS analytical data and reports.
d) An evaluation of disposal alternatives.
e) Information concerning other industrial sources and existing regulatory exemptions.

This report contains the results of the RMC studies in these areas, plus conclusions and recommendations concerning the present situation and future studies.

SOURCE STUDIES

II. SOURCE LOCATION STUDIES

The goal of this study was to determine the concentration of Radium-226 in various samples obtained from the MSD sewer system and locate the source(s), if possible. As of January 1, 1981, a total of 29 samples have been submitted and analyzed using either Ge(Li) gamma spectroscopy or radon emanation analytical procedures. Whenever possible, a comparison and verification of NUS data was performed.

Table 1 shows the results of analyses performed on various MSD samples. The results have been ordered in approximate chronological sequence in terms of sampling dates. Results are recorded for Ra-226 only.

The first two samples are actual incinerator ash samples taken from Ash Basin No. 1. Sample #1 is a composite of 14 samples taken by MSD during the transfer of ash from Basin No. 1 to the Angelica Street storage site. This ash was generated during the period from 1973 to March, 1977. Sample #2 was taken from Basin No. 1 in July, 1980, and presumably represented recent (early 1980) ash production.

Since there was some uncertainty concerning the actual age of ash in the storage basins, current ash samples were obtained by collecting filter cake prior to discharge in the incinerators. This filter cake was then ignited in the MSD laboratory, and the resulting ash, termed "simulated ash", was considered representative of actual ash production at the time of filter cake collection. Samples #4 and #5 are simulated ash collected on August 15-18 and September 22-27, 1980, respectively. In addition, monthly composites were collected for August, September and October, 1980, and are listed as Samples #10, 11 and 12.

Table 1

MSD Sample Analysis Results

Sample Number	Sample Source	Sample Location	Sample Date	Sample Type	NUS No.	NUS Result Ra-226 pCi/g	RMC Result Ra-226 pCi/g
1	Bissell Point Ash Basin #1	Ash Relocated to Angelica St.	12/20/79 01/09/80	14 grabs Samples	12041-12054	8.7 ± 1.9 (Composite)	5.4 ± 0.7 (average)
2	Bissell Point Ash Basin #1	SW Corner New Deposit	7/31/80	Grab	12039	9.3 ± 5.0	9.9 ± 1.0
3	Bisell Point Grit	Containers	7/31/80	Composite	12040	1.8 ± 1.0	0.8 ± 0.1
4	Bissell Point Filter Cake	Simulated Ash	8/15/80-8/18/80	Composite	12157	7.0 ± 2.6	3.7 ± 0.6
5	Bissell Point Filter Cake	Simulated Ash	9/22/80-9/27/80	Composite	-	-	4.2 ± 0.4
6	Bissell Point Interceptor	Branch St. & Hall Dropshaft	9/22/80-9/26/80	Composite	-	-	0.7 ± 0.2
7	Outfall to Bissell Point Interceptor	Foot of Destreham Street Sewer	9/22/80-	Composite	-	-	59 ± 5.9
8	Bissell Point Interceptor	S. Gateway to B.P. Pump Station	9/22/80-9/26/80	Composite	-	-	1.7 ± 0.2
9	Bissell Point Interceptor	Withers Street & Hall Dropshaft	9/22/80-9/26/80	Composite	-	-	1.0 ± 0.1
10	Bissell Point STP	Simulated Ash	8/1/80-8/31/80	Composite	-	-	3.0 ± 0.5

Table 1

MSD Sample Analysis Results, cont.

Sample Number	Sample Source	Sample Location	Sample Date	Sample Type	NUS No.	NUS Result Ra-226 pCi/g	RMC Result Ra-226 pCi/g
11	Bissell Point STP	Simulated Ash	9-1/80-9/30/80	Composite	-	-	3.3 ± 0.5
12	Bissell Point STP	Simulated Ash	10/1/80	Composite	-	-	2.9 ± 0.4
13	Lemay STP	West Lagoon Ash	8/19/80	Grab	-	-	0.9 ± 0.2
14	Alpha Portland Cement Co.	Bottom Ash	11/04/80	Grab	-	-	2.4 ± 0.3
15	West Lake Landfill Leachate	Collection Tank	11/12/80	Grab	-	-	1.1 ± 0.3(pCi/1)
16	Mallinckrodt Chemical Works	East Basin Sludge	12/1/80	Grab	-	62 ± 2	

Samples #6-9 are sludge samples collected directly from sewer intercepts within the MSD system, in September, 1980.

Samples #13 and #14 are from sources which provide useful comparisons, and Samples #15 and #16 are from known or suspected contributers of Ra-226 to the sewer system.

In general, NUS results tend to be slightly higher than RMC results, within the range of errors reported. There is agreement, however, that incinerator ash generated prior to August, 1980, is in the range of 5-10 pCi/g. Following this date, simulated ash samples yielded Ra-226 levels of 3-4 pCi/g. The single NUS result shown for simulated ash (Sample #4) was nearly twice the RMC result (7 pCi/g vs 3.7 pCi(g); however, a third analysis by Eberline gave 3.2±1.0 pCi/g, which tends to agree with RMC results for simulated ash.

Analyses of sewer interceptor samples showed a significant Ra-226 content in the Destrehan Street sewer, when compared to the other sampling points.

Conclusions drawn from these results tend to correspond to known actions taken by a user of the MSD system, Mallinckrodt, Inc. This user notified MSD that it has in the past routinely disposed of radioactive waste products by discharging them into the sewer. According to Mallinckrodt, Inc., all discharges were performed in compliance with appropriate USNRC regulations and license requirements. However, a concern for the possibility of concentrating high levels of Ra-226 in the ash caused Mallinckrodt, Inc. to cease discharges from one of it operations in July, 1980. This corresponds to an apparent decrease in Bissell Point ash at that time.

Despite this decrease, Bissell Point ash continues to have a higher Ra-226 content than the adjacent Lemay Sewage Treatment Plant ash, indicating additional sources. The high levels detected in the Destrehan Street sewer tend to support a conclusion that continued activities at Mallinckrodt are producing elevated Ra-226 levels in the Bissell Point ash.

Results also show that the Bissell Point ash being produced at this time does not contain significantly higher Ra-226 content than the bottom ash presently used in cement production. In addition, there appears to be little contirubtion from the West Lake Landfill leachate.

CURRENT REGULATORY LIMIT APPLICABLE TO

POSSESSION, RESUE OR DISPOSAL

III. CURRENT REGULATORY LIMITS APPLICABLE TO POSSESSION, REUSE OR DISPOSAL

In order to determine MSD's liability concerning possession of ash containing elevated levels of Ra-226, and to evaluate possible methods of disposal, RMC has performed an exhaustive review of pertinent rules and regulations related to this problem. Appendix 1 is a detailed report on this review. A summary of the significant findings and conclusions is provided below.

Documents reviewed included appropriate regulations from the State of Missouri, the U. S. Environmental Protection Agency and the U. S. Nuclear Regulatory Commission. The process used was to first determine if any of the appropriate regulations addressed the matter at hand; second, if they did, did they specifically apply to MSD or any other involved party; and third, has MSD, or any other involved party, been in violation of any applicable rule or regulation.

In general, there are two areas of consideration related to MSD's possession of Ra-226. The first is the EPA and state regulations concerning management of hazardous waste, and the second is the NRC and state regulations concerning licensing of radioactive materials.

It appears that MSD ash containing Ra-226 does not quality as "hazardous waste", under either the Resource Conservation and Recovery Act (RCRA) or the Missouri Hazardous Waste Management Law (MHWML). The conclusion is based on the definition of "hazardous waste", which applies only to materials with characteristics of a) ignitability, b) corrosivity, c) reactivity, and d) EP toxicity. Hence, radioactivity, by itself, is not a characteristic which classifies a waste as hazardous, <u>under the present regulations</u>.

Possession of Ra-226, a naturally occurring radioactive material, per se, is not within the scope of NRC regulations. However, if one is a licensee by virtue of the possession of other licensed materials, then certain of the NRC regulations applies to all radioactive materials within the control of the licensee. In spite of this provision, RMC believes MSD is not in violation of any NRC regulation concerning possession of Ra-226. Receipt and disposal of this material is discussed below and in the following sections.

Receipt of radioactive material must be in accordance with all applicable regulations. Therefore, MSD must verify that all transfers are performed in a manner which is consistant with regulations and license conditions. Since Mallinckrodt, Inc. discharges licensed material (uranium), as well as radium, these discharges must be in compliance with NRC regulations. These regulations require that licensed material discharged to a sanitary sewage system be "...readily soluble or dispersible in water..." (10CFR20.303). The NRC has not defined in the regulations "readily soluble" or "dispersible", so the actual meanings are somewhat unclear. However, based on common usage and based on verbal discussions with the NRC Standards Branch, a procedure which "flushes solids from a basin using a fire hose", as is the case at Mallinckrodt, Inc., would not likely be considered readily soluble or dispersible in water. A representative from Inspection and Enforcement Branch also indicated that materials requiring mechanical agitation to remain in suspension have not in the past been considered "dispersible". Thus, the possibility exists that some releases to the sewer system (and hence transfers to MSD) may be in violation of applicable regulations. A further discussion is presented in Section VIII.

The State of Missouri Division of Health, Radiation Protection Regulations, require that "every person who receives radioactive waste material for holding and preparation prior to disposal, shall first obtain a permit from the Division of Health for such holding and preparation." These regulations are not totally clear, but the possibility exists that any quantity exceeding "Exempt Quantities" (for Radium 226 = 0.3 μCi) might be considered radioactive waste. In that case, since MSD does not have a permit, it would be in violation of state regulations. The need for further definition of this situation is addressed in Section VIII.

Disposal of material containing Ra-226 by MSD is discussed in the following section. Additional information and discussion concerning potential future problems are presented in Sections VII and VIII.

EVALUATION OF POSSIBLE DISPOSAL ALTERNATIVES

IV. EVALUATION OF POSSIBLE DISPOSAL ALTERNATIVES

The primary concern regarding disposal of material containing Ra-226 is that it will be classified as "hazardous waste" or "radioactive waste", thereby necessitating special handling, shipping and disposal procedures. These procedures would prove to be extremely costly to implement, and perhaps not technologically feasible.

As indicated in Section III, the MSD ash is not presently considered "hazardous waste" by virtue of its radioactivity, either by the EPA or the State of Missouri. However, proposed EPA rulemaking would define waste as hazardous if Ra-226 levels exceed 5 pCi/g (43FR No. 232,12/18/79). Thus, the waste classification of MSD ash could change in the near future.

Also discussed in Section III is the State of Missouri classification of radioactive waste. This classification is totally undefined, and will require a ruling by the Missouri Division of Health.

If the ash is considered "radioactive waste" by the state, few options are available. If disposal as radioactive material were mandated, options might include a commercial radioactive waste disposal site, or possibly a licensed mill tailings disposal site. In either case, packaging, transportation and disposal costs would be enormous, perhaps as high as several millions of dollars. If disposal were not absolutely required, long term on site storage would be the most attractive option. This storage would require some site preparation and material control, but would provide significant cost savings.

If the ash is not consider "radioactive waste" or "hazardous waste", then a few additional options may be considered. However, when considering large volumes, disposal options for even "clean" materials are limited.

One such option might be as fill in a landfill. Unfortunately, so long as the ash contains elevated levels of Ra-226, no matter how small, any such use may be undesirable from a political standpoint. In addition, the NRC has recently set target decontamination criteria of 5 pCi/g Ra-226 in soil for a certain licensee. If this criteria is adopted by other agencies and applied to other sites, it could impact on MSD. That is, if this criteria were adopted and MSD had disposed of this ash in a landfill or in some other similar manner, MSD might be liable for recovering all ash exceeding the established criteria.

The proposed use of ash as a component in cement manufacture appears very appealing at this time. Assuming the State of Missouri has not ruled that this material is "radioactive waste", there would seem to be no regulatory restrictions prohibiting this use. In addition, RMC concurs with the NUS safety evaluation, which concluded that the use of this ash in concrete products would not pose an unacceptable risk to the population. Finally, it appears that the Ra-226 content in the MSD ash is not significantly different than the Ra-226 content in the bottom ash presently used in commercial cement manufacture.

Any other use which would incorporate this ash in other materials, thus diluting the Ra-226 concentrations, would deserve serious consideration and evaluation.

EVALUATION OF POSSIBLE REGULATORY EXEMPTIONS

V. EVALUATION OF POSSIBLE REGULATORY EXEMPTIONS

As described in Section III, there are apparently no regulatory controls over the MSD ash at this time. Therefore, there is no need to pursue possible regulatory exemptions, unless the existing conditions change. Two such changes are conceivable:

1) The State of Missouri might rule the MSD ash is "radioactive waste".
2) The EPA might enact rulemaking defining waste as hazardous if it contains more than 5 pCi/g Ra-226.

In the first case, RMC believes an exemption would be possible, since the Department of Health routinely provides regulatory rulings on a case-by-case basis. Thus, RMC feels that a submission which described a proposed use and provided a valid radiological assessment indicating minimal radiological impact, would have a good chance of being accepted by the state.

The second case might be more difficult. Once "hazardous waste" is defined by the EPA in terms of Ra-226 content, that numerical value (5 pCi/g, or 15 pCi/g, or whatever) is not likely to be changed, especially in the upward direction. That is, even if MSD (or any other agency) could demonstrate that the standard is ridiculously conservative, it would not change. This is due to the fact that these criteria are usually based more on political considerations than scientific fact.

The only alternative action for MSD would be to obtain an exemption for the process involved. This would not be inconsistant with past EPA actions,

which, for example, have exempted Publicly Owned Treatment Works' (POTW) domestic sewage (but not sludge) from certain of the waste management requirements. Since this exemption would not be specific to MSD, it would probably have to be approached on an industry-wide basis. This would require a coordinated effort involving many individual organizations, and would probably need both scientific and political force.

OTHER INDUSTRIES UTILIZING MATERIALS CONTAINING RADIOACTIVITY

VI. OTHER INDUSTRIES UTILIZING MATERIALS CONTAINING RADIOACTIVITY

It has been know for some time that many industrial activities utilize materials containing radioactivity. Appendix B is a very brief report containing some facts and figures related to this problem. These are presented in an effort to put the potential MSD problem into the proper prospective and to identify possible contributers to the MSD system.

Significant contributions could come from industries which process phosphate ores for the production of fertilizer and gypsum, or industries which process ores from uranium or non uranium (fluospar, hematite, iron, copper, talc, coal) mining operations. Another source might be ash piles or ash ponds from coal fired power plants.

As can be seen in the report, considerable study has been devoted to the determination of radioactivity in building materials. In general, the Ra-226 content in many materials such as brick, concrete and plaster, may equal or exceed that in the MSD ash.

In addition, naturally occurring radionuclides may be found in other items such as ceramic glass, dental procelain and lamp mantles.

SUMMARY AND CONCLUSIONS

VII. SUMMARY AND CONCLUSIONS

Based on analyses performed by RMC and NUS, the Radium-226 content of incinerator ash generated at the Bissell Point prior to July, 1980, was generally greater than 5 pCi/gram but less than 10 pCi/gram. The total volume of ash known to contain these levels is about 150,000 cubic yards and is located on MSD property on Angelica Street and in Ash Basin No. 2 at the Bissell Point Plant. An additional 80,000 cubic yards of ash was placed in the Hall Street landfill. The exact Ra-226 content is unknown, although elevated levels are indicated.

Since July, 1980, the Bissell Point ash has contained about 3 pCi/gram of Ra-226. Similar ash at the Lemay Plant contains about 1 pCi/gram.

Sewer system sampling has shown a major portion of the Ra-226 activity is presently coming from the Destrehan Street sewer, to which Mallinckrodt, Inc. is a major contributor. In addition, Mallinckrodt has previously notified MSD that they (Mallinckrodt) have been routinely discharging radioactive materials, including Ra-226, to the sewer for many years. The decrease in Ra-226 activity in July corresponds to a cessation of discharge activities from one of Mallinckrodt's operations. The conclusion is that Mallinckrodt, Inc. has been, and remains, the major, if not the only, source of elevated Ra-226 levels in incinerator ash.

A review of the applicable regulations indicates MSD is not presently in violation of any regulations concerning possession of Ra-226 in ash. Disposal will depend on the State of Missouri's ruling concerning the definition of "radioactive waste". Even if the ash is so defined by the state, perhaps no more than issuance of a permit to process this material

will be required. Continued receipt of material from Mallinckrodt may involve a potential violation of NRC regulations, if the Mallinckrodt material does not meet the "readily soluble or dispersible" criteria.

At this time it appers there are no regulatory restrictions on MSD concerning disposal of this material. However, political and radiological safety evaluations should be made prior to any intended use. It would seem that the proposed use of ash as an ingredient in commercial cement is an acceptable and attractive disposal method at this time.

An implementation of proposed rule making by the EPA could seriously jeopardize MSD attemtps to get rid of this ash. If "hazardous material" is defined by Ra-226 content in excess of 5 pCi/g, MSD would face potentially massive disposal costs. In that event, it would seem prudent to pursue an exemption clause, on behalf of all sewage treatment agencies, on a national basis.

RECOMMENDATIONS

VIII. RECOMMENDATIONS

In order to solve the present problem, and to avoid future ones, RMC recommends several actions for MSD to pursue.

The first recommendation relates to present and past releases to the sewer by Mallinckrodt. Since there is some questions concerning the terms "soluble or dispersible", RMC recommends that MSD obtain an official definition from the NRC for these terms, and then ask Mallinckrodt to demostrate compliance.

RMC recommends that MSD not accept Mallinckrodt waste from the C-T operation until Mallinckrodt demonstrates complete compliance with all applicable NRC regulations.

RMC recommends that MSD obtain a ruling from the State of Missouri concerning the definition of "radioactive waste", permit requirements and any other regulatory restrictions.

In the absence of a ruling requiring strict controls by the State of Missouri, RMC recommends that MSD pursue the disposal of ash by sale/transfer to the cement manufacturer as quickly as possible. Concurrently, MSD should maintain constant review of EPA regulations, since this disposal can be completed only if the EPA has not enacted the regulation which defines the ash as "hazardous waste" due to its Ra-226 content.

RMC recommends that MSD perform a detailed radiological evaluation of the Hall Street Landfill. This evaluation should include measurements of external gamma radiation, radon emanations and radium content in the landfill, and should be made irrespective of the intended use of the

site. In addition, under no circumstances should MSD further dispose of additional ash as part of a landfill.

The reason for this recommendation is the present activities of the NRC, which are directed toward requiring decontamination of soil to certain target criteria, which could result in an expensive recovery operation for MSD.

Irrespective of the above recommendations, under no circumstances should MSD accept waste which will cause Ra-226 levels to exceed 5 pCi/gram in the ash. This recommendation is made in light of the proposed EPA rule-making which would define waste as hazardous if Ra-226 exceeds 5 pCi/gram. Thus, MSD is already in possession of large quantities of material exceeding 5 pCi/gram, and should not extend their liability in this area.

APPENDIX A

Report on Regulatory Review

REPORT ON REGULATORY REVIEW

A. State of Illinois

1. Illinois Department of Public Health - Rules and Regulations for Protection Against Radiation.

2. Illinois Environmental Protection Act.

3. Illinois Environmental Protection Agency Proposed Rule - Criteria for Identification and Listing of Hazardous Wastes.

B. State of Missouri

1. The Division of Health of Missouri - Radiation Protection Regulations.

2. Missouri Department of Natural Resources - Hazardous Waste Management Law and Rules.

C. U. S. Nuclear Regulatory Commission - Code of Federal Regulations, Title 10, Part 20 - Standard for Protection Against Radiation.

D. U.S. Environmental Protection Agency - Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (Public Law 94-580) including the following specific references:

1. Resource Conservation And Recovery Act of 10/21/76 (RCRA).

2. Proposed Rules under Sections 3001, 3002, and 3004 of RCRA - (40CFR250) which appeared in 43FR No. 243, 12/18/78.

3. Revisions to Final Rule and Interim Final Rule (40CFR260) - EPA Hazardous Waste Management System, which appeared in 45FR No. 98, 5/19/80.

4. Final Rule (40CFR Part 257) - Criteria for Classification of Solid Waste Disposal Facilities and Practices, which appeared in 44FR No. 179, 9/13/79.

5. "Municipal Sludge Management Environmental Factors - Technical Bulletin," which appeared in 42FR No. 211, 11/2/77.

6. Clean Water Act of 1977 (Public Law 95-217).

Discussion of Specific Regulatory Documents

I. ILLINOIS

1. Illinois Department of Public Health - Rules & Regulations for Protection Against Radiation.

Conclusion:

Material containing >0.1 pCi/gram Radium 226 would be considered "licensable material" in the State of Illinois and can be disposed of within the State of Illinois only with explicit written permission from the Department of Public Health and only on land owned by the State or Federal Government.

Highlights:

- Section 213.9 of the "Radiation Protection Act" defines radioactive material as "any solid, liquid or gaseous substance which emits radiation spontaneously."

- Section 230 of the "Radiation Waste Act" authorizes the State Director of Public Health "to procure lands for storage of radioactive waste" (Radioactive waste is not defined further).

- Part C - Licensing of Radioactive Material.

C.4(a)-Exempt Concentrations - exempt from licensing if concentrations are not in excess of the values in Schedule A. For Ra226 = 1 x 10^{-7} uCi/ml in solid or liquid, i.e., 0.1 pCi/gram.

C.4(b)-Exempt Quantities - refers to Schedule B; None listed for radium isotopes.

C.4(c)(3)(ii)-Additional Exemptions - Articles containing <0.1 uCi radium which were acquired prior to effective date of regulations (Radiation Protection Act - 8/16/63).

C.37-Persons possessing accelerator produced or naturally occuring radioactive material on the effective date of the regulations for which a specific license is required [yes in this case, since exemptions are not provided by C.4(a) and C.4(b)], shall be deemed to possess such a license issued under the act.

- Part D - Standards for Protection Against Radiation.

D.106-Concentrations in Effluents to Unrestricted Areas:

Limits release by licensees to limits of Appendix A, Table II (Annual Averages). For Ra226: S - 3 x 10^{-8}]
I - 3 x 10^{-5}] uCi/ml in water

(.03 pCi/ml and 30 pCi/ml respectively)

D.203-Caution Signs, Labels and Signals.

D.203(e)(i) requires "caution radioactive material" be posted in each area or room in which "any radioactive material" is used or stored in an amount greater than 10 times Appendix B quantities. For Ra226 = 10 x .01 uCi = 0.1 uCi.

D.301-Waste Disposal (applicable to "Licensees"). Allows disposal of "radioactive material":

(a) by transfer to a licensee as per Part C.

(b) pursuant to D.106 (effluent limits).

(c) as per D.302 - by agency permission (only on land owned by State or Federal Government).

(d) as per D.303 - release into sanitary sewer system; Must be readily soluble or dispersable in water; within limits of Appendix A, Table I, Column 2; For Ra226: S - 4 x 10^{-7} uCi/ml.

(e) as per D.304 (Burial in Soil) and D.305 (Incineration) - both require agency permission.

2. Illinois Environmental Protection Act including Illinois Environmental Protection Agency Proposed Rule - Criteria for Identification and Listing of Hazardous Wastes.

Conclusion:

Sludge from a domestic sewage treatment plant is not considered a "hazardous waste" by the State of Illinois. It is, however, considered "municipal waste" and as such, may require permitting for transportation as per Chapter 9 of the Illinois Pollution Control Board Rules and Regulations which define sludge as "pollution control waste."

Highlights:

- Section 1.3.11-"Waste" defined: Includes "sludge from a wastewater treatment plant" but does not include "solid or dissolved material in domestic sewage."

- Section 1.3.9-"Municipal Waste" defined: Includes "general household and commercial waste."

- Section 1.4-Exclusions: Specifically excluded as "materials which are not wastes."

  (a) solid and dissolved materials in domestic sewage.

  (b) radioactive material discarded in accordance with the provisions of.....regulations promulgated pursuant to the Radiation Protection Act.

- Section 1.4.2-Wastes which are not "hazardous wastes" include "municipal wastes."

- Section 2.0-Characteristics of hazardous waste:

  (a) "Radioactivity" is not a characteristic listed.

- Section 3.0-Lists of Hazardous Wastes:

  (a) "Radioactive Material" and/or "Radium" do not appear on any included lists.

(Note: A list of "Hazardous Waste Disposal Sites" in Illinois are attached as Appendix II to this report. However, even though sludge from a domestic sewage treatment plant is not considered "hazardous" by the Illinois EPA, explicit permission would be required from the Illinois Department of Public Health to dispose of the MSD sludge at any of these sites due to the assumed radium content).

II. MISSOURI

1. Division of Health of Missouri - Radiation Protection Regulations.

Conclusions:

Since "radioactive material" is defined in the usual all encompassing terms, "radioactive waste" is not formally defined and, therefore, by inference is material containing in excess of effluent and/or exempt quantity limits, MSD must obtain a permit from this agency for "holding and preparation" of the sludge prior to disposal. Disposal within the State of Missouri is permissable only at sites approved by and registered with the Division of Health. Additionally, quantities of Ra226 > 0.1 uCi (@ 5pCi/gram $\approx 2 \times 10^4$ grams of sludge) are non-exempt quantities.

Highlights:

- Section 3-Definitions:

  (a) "Radioactive Material" is any material, solid, liquid or gas, that emits radiation spontaneously.

- Section 7-Maximum Permissable exposure limits; Internal exposure - non-occupational:

  (a) doses limited by effluent limits for air and water of Appendix I, Table 2, Column 2 (water) and Column 3 (air). For Ra226 (water)
  S - 1×10^{-6} uCi/ml
  I - 3×10^{-5} uCi/ml

- Section 12-Disposal of Radioactive Wastes:

  (a) release limited to Appendix I, Table 2 limits.

(b) "Every person who receives radioactive waste material for holding and preparation, prior to disposal, shall first obtain a permit from the Division of Health for such holding and preparation."

(c) No owner or user shall dispose of radioactive waste materials by dumping or burial in soil except at sites approved and registered with the Division of Health.

(d) Permits discharge into sanitary sewer provided that:

(1) readily soluble or dispersable in water.

(2) concentration averaged over any one day $\leq$ limits specified in Appendix I, Table 2.

(3) total quantity/year $\leq$ one curie.

- Appendix I, Table 1: "Exempt Quantities"

- For Radium 226 = 0.1 uCi (= 10^5 pCi or @ 5pCi/gram 2 x 10^4 grams of sludge).

2. Missouri Department of Natural Resources - Hazardous Waste Management Law and Rules.

Conclusion:

Section 260.355 of these regulations specifically exempt "radioactive wastes regulated by laws of the Federal Government or of this State." The previous discussion (Radiation Protection Regulations) concluded that the MSD sludge @ 5 pCi/gram Radium 226 would be regulated by the Division of Health, not the Department of Natural Resources, if only radiological considerations are applied to this analysis. (However, this is not clear cut - See Highlights on Chapter 4, Paragraph 7 below.)

Additionally, if MSD discharges are not regulated by the Missouri Clean Water Commission, and if discharges have some other property or constituent (other than "radioactivity") which meets the definition of "hazardous" under the regulations, MSD must comply with Title 10, Division 25, Chapter 5 - "Rules Applicable to Generators of Hazardous Waste" and may need to comply with Chapter 7 - "Rules

Applicable to Owners/Operators of Hazardous Waste Facilities." It is not clear if a POTW, whose input is domestic sewage mixed with commercial/industrial waste, is a "generator" or "treater" or both.

Highlights:

- Section 260.355-Exempted Waste

  (1) "Radioactive wastes regulated by laws of the Federal Government or of this State."

- Section 260.360-Definitions - Waste defined.

  - includes "certain residual materials, to be specified by the regulations which may be sold for the purposes of energy or materials reclamation, reuse or transformation into new products which are not wastes."

- Section 260.390-Duties of hazardous waste facility owners or operators:

  (1) requires hazardous waste facility permit as specified in 260.395.

- Section 260.395 - 13(2)

  - permit not required for municipal wastewater treatment plants whose discharges are regulated by a permit issued by the Missouri Clean Water Commission.

- Chapter 4 - Methods for Identifying Hazardous Waste.

  Paragraph (6)(d)-Exempt from regulations under Hazardous Waste Management Law and Rules.

  6. Sludge from wastewater treatment plants that accept only domestic sewage. (undefined)

  Paragraph (7)-Identification Procedure.

  (A)-5: Wastes designated as "radioactive," to be exempt, must be shown to have either of the following characteristics:

  (I) Average Radium 226 concentration $\leq$ 5 pCi/gram for solid waste or $\leq$50 pCi/liter combined Radium 226/228 for liquid wastes.

(II) Total Radium 226 $\leq$10 uCi for any single discrete source.

III. U.S. NUCLEAR REGULATORY COMMISSION: Code of Federal Regulations, Title 10, Part 20 - "Standards for Protection Against Radiation."

Conclusion:

Paragraph 20.2, Scope, specifically limits applicability to material licensed pursuant to the regualtions of Parts 30-35 (by-product material), 40 (source material), 70 (special nuclear material) and 50 (production and utilization facilities). Therefore, NRC regulations are not applicable to naturally occurring radioactive material, i.e, Radium*.

However, Mallincrodt, Inc. is a licensee pursuant to the regulations of this part and their effluent to sanitary sewer systems is regulated by 20.203. For completeness, appropriate sections of 10CFR are highlighted below.

Highlights:

- 20.2 Scope-Naturally occurring radioactive material not subject to the regulations of this part by omission.

- 20.3-Definitions:

  - (a)(13) defines radioactive material as "any such material whether or not subject to licensing control by the commission."

- 20.106-Radioactivity in effluents to unrestricted areas.

  (a) a licensee shall not possess, use.....licensed material so as to release to an unrestricted area concentrations (averaged over one year) greater than the limits of Appendix B, Table II, except as provided by approval of proposed disposal procedures pursuant to 20.302.
  For Radium 226: S - 3×10^{-8}uCi/ml
  I - 3×10^{-5}uCi/ml

* Naturally occurring radioactive material contained in uranium mill tailings is regulated by the Commission pursuant to the "Uranium Mill Tailings Act of 1978."

Waste Disposal:

- 20.301 - No licensee shall dispose of licensed material except:

  (a) by transference to another licensee pursuant to 10CFR30, 40 or 70.

  (b) pursuant to 20.302 (special permission - See below).

  (c) as provided by 20.106 (effluent limits), 20.303 (release into sanitary sewers - See below) and 20.304 (now deleted - See below).

- 20.302 - Allows for application "to the Commission for approval of proposed procedures to dispose of radioactive material in a manner not otherwise authorized in the regulations in this chapter."

- 20.303 - Disposal by release into sanitary sewage systems.

  A licensee can dispose of licensed material into sanitary sewer systems if:

  (a) readily soluble or dispersable in water.

  (b) quantity of licensed or other radioactive material released into the system by the licensee in any one day does not exceed the larger of:

    (1) Average daily concentration limit specified in Appendix B, Table I, Column 2:

    (Radium 226: S - 4×10^{-7} uCi/ml)

    (2) Ten times the quantity of such material specified in Appendix C:

    (Radium 226 = 10 x .01 = 0.1 uCi)

  (c) the quantity of any licensed or other radioactive material released in any one month.....will not exceed the limits of (b) (1) above.

(d) the gross quantity of licensed and other radioactive material released into the sewage system by the licensee does not exceed one curie per year.

- 20.304 - Disposal by Burial in Soil.

This general disposal allowance has been deleted (45FR No. 212, 10/30/80). Permission must now be granted pursuant to the requirements of 20.302.

- 20.305 - Disposal by Incineration.

Requires permission pursuant to the requirements of 20.302.

IV. U.S. ENVIRONMENTAL PROTECTION AGENCY: Code of Federal Regulations, Title 40; Solid Waste Disposal Act as Amended by the Resource Conservation and Recovery Act (Public Law 94.580).

Background:

Subtitle C of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (RCRA) directs the EPA to promulgate regulations for the management of hazardous waste. RCRA and subsequent proposed and final regulations promulgated under its authority were reviewed to assess the applicability of these and referenced regulations to the general problem of sewage sludge from water treatment works and specifically to such material containing radioactivity, i.e., Radium 226.

Summary/Conclusions:

The regulation of sewage sludge is a complex matter because such sludges fall within the jurisdiction of several federal environmental programs.

Under Section 1004 (27) of RCRA, the definition of "solid waste" specifically includes "sludge from a waste treatment plant." Section 1004 (26A) includes wastes from a "municipal wastewater treatment plant."

EPA will, therefore, regulate sewage sludge under RCRA; either under Subtitle D (State and Regional Solid Waste Plans), where it has already promulgated regulations covering sewage sludge (44FR No. 179; Final Rule: Criteria for Classification of Solid Waste Disposal Facilities and Practices) or under Subtitle C (Hazardous Waste Management) where sludges that meet the EPA criteria as "Hazardous" will be regulated.

Under Section 102 of the Marine Protection Research and Sanitaries Act, EPA regulates the ocean dumping of sewage sludge. In addition, under Section 405 of the Clean Water Act (CWA), EPA has established guidelines for the disposal and utilization of sewage sludge. Section 405(e) of the CWA specifically requires owners and operators of Publicly Owned Treatment Works (POTW) to comply with established EPA guidelines for the disposal and utilization of sludge. Additionally, sewage sludge which may be distributed to the public as a soil conditioner or fertilizer, may be regulated under the Consumer Product Safety Act (CPSA) or the Toxic Substances Control Act (TSCA) in addition to Section 405 of the CWA.

Section 1006 of RCRA specifically instructs the EPA Administrator to integrate the Solid and Hazardous Waste Programs with other EPA regulatory programs. EPA has, therefore, decided to develop a comprehensive set of regulations to deal with sewage sludge management.

Pending promulgation of this comprehensive sewage sludge regulation, sewage sludge will be regulated by Subtitle C of RCRA. Like any other solid waste, sewage sludge that exhibits any of the characteristics of hazardous waste pursuant to Subtitle C, Section 3001 of RCRA (40CFR261 - Identification and Listing of Hazardous Waste) must be managed as a hazardous waste.

Although the hazardous characteristic of "Radioactivity" does not yet appear in the Final Rule and Interim Rule to 40CFR261 (45FR No. 98, 5/19/80) which addresses only the first four (4) characteristics originally proposed ("ignitability", "corrosivity", "reactivity", and "toxicity"), final regulations are expected shortly which will include radioactivity as a hazardous characteristic as proposed (43FR No. 243, 12/18/78). These proposed rules under Section 3001 of RCRA define waste designated as hazardous due to radioactivity if:

(1) Radium 226 >5 pCi/gram average concentration for solid materials,

or

>50 pCi/liter Radium 226 + Radium 228 for liquids

(2) Radium 226 >10uCi for any single discrete source.

It is, therefore, concluded that sewage sludge, independent of any other characteristic or constituent defined as hazardous under Subtitle C of RCRA, if it contains an average concentration of Radium 226 in excess of 5 pCi/gram is a hazardous waste under RCRA. Therefore, it would be subject to Subtitle C requirements. The applicable requirements as final or interim final regulations are presented in the Federal Register of Monday, May 19, 1980 (45FR No. 98) as indicated below:

40CFR Section	Corresponding RCRA Section and Title	45FR No. 98 Part
260	Definitions used in other parts corresponding to Sections 3001 - 3004 rules, and general provisions	Part II
261	Section 3001: Identification and Listing of Hazardous Wastes	Part III
262	Section 3002: Standards Applicable to Generators of Hazardous Waste	Part V
263	Section 3003: Standards Applicable to Transporters of Hazardous Waste	Part VI
264	Section 3004: Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	Part VII
265	Section 3004: Interim Status Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	Part VII
122 & 124	Section 3005: Permits for Treatment, Storage, and Disposal of Hazardous Waste	Part X
123	Section 3006: Guidelines for Authorized State Hazardous Waste Programs	Part X

Highlights:

In the pages that follow, detail is presented from the key reference documents which is considered to be related to or supportive of the conclusions of the preceding section. In addition to references indicated in this section, find attached as Appendix I, a bibliography of documents which was generated from these investigations related to disposal considerations and options for sewage sludge and wastewater.

43FR No. 243; 12/18/78

U.S. EPA (40CFR Part 250) - Hazardous Waste Guidelines and Regulations - Proposed Rules under Sections 3001, 3002 and 3004 of the Solid Waste Disposal Act as amended by Public Law 94-580 (Resource Conservation and Recovery Act of 10/21/76).

- Section 3001: Requires the EPA Administrator to develop and promulgate criteria for identifying the characteristics and for the listing of hazardous wastes within 18 months of RCRA effective date.

- Section 3002: Requires the EPA Administrator to develop and promulgate regulations establishing such standards applicable to generators of hazardous waste as identified under Section 3001.

- Section 3004: Requires the EPA Administrator to promulgate standards applicable to owners and operators of hazardous waste treatment, storage and disposal facilities.

- Page 58950: Candidate Characteristics of Hazardous Waste:

1. Ignitability
2. Corrosivity
3. Reactivity
4. Toxicity
5. Radioactivity
6. Infectiousness
7. Phytotoxicity
8. Teratogenicity and Mutagenicity

- Page 58951: "Sewage Sludge from POTW's is excluded from coverage under this regulation and will be regulated under Section 405 of the Clean Water Act."

(This exclusion was repealed in the final rule - See 45FR No. 98, pp. 33101-33102.)

- Page 58955: 250.11 Definitions

  - (b)(4) Publicly Owned Treatment Works or POTW - defined in Section 212 of the Clean Water Act.... which has jurisdiction over the indirect discharges to and the direct discharges from such treatment works.

    (See discussions on the Clean Water Act in subsequent pages.)

- Page 58959: 250.15(a)(5)

  (a) Waste designated as hazardous due to radioactivity:

  (1) Radium 226 >5 pCi/gram average concentration for solids

  or

  >50 pCi/liter Radium 226 + Radium 228 for liquids

  (2) >10 uCi Radium 226 for any single discrete source.

- Page 58998: 250.41 Definitions

  (66) Publicly Owned Treatment Works (POTW) - again, refers to definition in CWA.

- Page 59019: Appendix II - EPA Interim Primary Drinking Water Standards:

  Radium - 5 pCi/liter
  gross α- 15 pCi/liter
  gross β- 4 mrem/year

- Page 59022: 40CFR250; Identification and Listing of Hazardous Waste - Advance Notice of Proposed Rulemaking.

  - expands characteristics pursuant to Section 3001 of RCRA to include radioactivity and toxicity.

  (a) Radioactivity: Solid waste is hazardous waste if not source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended, and if a representative sample of the waste:

(1) Radium 226 >5 pCi/gram for solids or >50 pCi/liter Radium 226 + Radium 228 in liquids as determined by either of methods in Appendix I, (1. Precipitation 2. Radon Emanation)

or

(2) total Radium 226 >10 uCi for any single discrete source.

45FR No. 98; 5/19/80

U.S. EPA Waste Management System; Revision of Final Rule and Interim Final Rule.

- Page 33075: 260.10 Definitions

(57) POTW - as previously defined.

- Page 33090: 261.2 Definitions of Solid Waste

- Refers to Section 1004(27) of RCRA; Specifically excludes "solid or dissolved materials in domestic sewage."

- Page 33096-33098: 261.4 Exclusions

1. Domestic Sewage:

Discussion on the applicability of general exclusion for POTW's, particularly if "domestic sewage" is mixed with industrial wastes.

- "Domestic Sewage" exemption first appeared in the definition of "solid waste" in the Solid Waste Disposal Act of 1965.

- Section 1004(27) of RCRA specifically excludes "solid or dissolved materials in domestic sewage."

- Mixed waste streams that pass through sewer systems to Publicly Owned Treatment Works (POTW) will be subject to the controls under the Clean Water Act.

(No exemption for privately owned facilities.)

- Exemption requires that non-domestic wastes mix with domestic wastes in a sewer system leading to a POTW.

- These regulations define domestic sewage as untreated sanitary wastes that pass through a sewer system. Such wastes are excluded from regulation as solid wastes. In addition, mixtures of wastes with domestic sewage that pass through a sewer system to a POTW for treatment are also excluded from regulation as solid wastes, prior to such treatment.

- Pages 33101-33102: 261.4 Exclusions - continued

7. Sewage Sludge

- Sewage sludge from POTW is not excluded from regulation under Subtitle C of RCRA.

- EPA is presently developing a comprehensive set of regulations to integrate existing environmental regulations for sewage sludge.

- Pending promulgation of this comprehensive sewage sludge regulation, like any other solid waste, if the sewage sludge exhibits characteristics of hazardous waste as established in Subtitle C, it must be managed as such.

44FR No. 179; 9/13/79

U.S. EPA, 40CFR Part 257; Final Rule; "Criteria for Classification of Solid Waste Disposal Facilities and Practices."

- Minimum criteria for determining what solid waste disposal facilities and practices pose adverse effects on health or the environment. Any operator or owner of a POTW must comply with these criteria when disposing of sludge on land. These criteria partially fulfill requirements of Section 405 of the Clean Water Act.

- The criteria do not apply to domestic sewage or treated domestic sewage but do apply to disposal of sludge resulting from the treatment of domestic sewage.

- The criteria discussed include considerations for the following:

1. Flood Plans	5. Food Chain Crops
2. Endangered Species	6. Disease
3. Surface Water	7. Air
4. Groundwater	8. Safety

The Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act (P.O. 95-217) December, 1977.

- Section 212: Definitions

"treatment works" - any devices or systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature.....

- Section 405: Disposal of Sewage Sludge

- Disposal requires accordance with a permit issued by EPA under Section 402, (National Pollutant Discharge Elimination System - NPDES), if resultant disposal would result in any pollutant from such sewage sludge entering navigable water.

Note: It must be assumed that the applicability of 40CFR261, (Identification and Listing of Hazardous Waste) constitutes the presence of a "pollutant" as defined by the Act.

Therefore, it is concluded that disposal of sewage sludge, if "hazardous" under RCRA, requires a NPDES permit if such disposal results in the material reaching navigable waters.

42FR No. 211, 11/2/77

U.S. EPA - Municipal Sludge Management Environmental Factors - Technical Bulletin.

This bulletin addresses factors important to the environmental acceptability of a particular sludge management option in a general manner. The document is not regulatory in nature, but rather provides information on items to be considered in evaluating grant applications. It presents generic environmental factors to be considered in evaluating disposal options, regardless of the specific nature of a particular sludge.

APPENDIX I

Additional References

1. Recycling Treated Municipal Wastewater and Sludge Through Forest and Crop Land. Edited by W.E. Sopper and L.T. Kardos. Symposium held August 21-24, 1972. The Pennsylvania State University Press, University Park, Pa.

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6. Wastewater Use in the Production of Food and Fiber--Proceedings. Conference held March 5-7, 1974, at Oklahoma City, Okla. EPA-660/2-74-041, June, 1974.

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APPENDIX B

Report on Industries Utilizing Materials Containing Radioactivity

APPENDIX II
HAZARDOUS WASTE DISPOSAL SITES

The following Landfills are those that accept Hazardous Waste under the IEPA Hazardous Waste definition:

	County	Name and Address	Permit Number Site Number
1.	Cook	Chicago/CID #2 Waste Management of Illinois, Inc. Post Office Box 1296 Calumet City, Illinois 60409 312/891-1500	1979-10-DE & Op 03160030
2.	Lake	Winthrop Harbor/BFI #1 BFI of Illinois, Inc. 1827 Walden Office - Suite 107 Schaumberg, Illinois 60195	1975-53-DE & OP 09780201
3.	Will	Joliet/ESL Waste Management of Illinois, Inc. 1530 North Broadway Joliet, Illinois 312/891-1500	1972-21-DE & OP 19704502
4.	Cook	Chicago/Paxton #2 Paxton Landfill Company 1201 South Ogelsby Chicago, Illinois 60633 312/646-9768	1978-10-DE & OP 03160033
5.	LaSalle	Ottawa/States Land Improvement Corp. Paul Degroot Post Office Box Ottawa, Illinois 6135 815/433-4045	1973-59-DE & OP 09908002
6.	Bureau	Sheffield/Nuclear #2 NECO Post Office Box 158 Sheffield, Illinois 61361 815/454-2624	1980-10-EX 01109503
7.	Henry	Atkinson/Henry County Landfill Barney Oldfield Rural Route #1 Atkinson, Illinois 61235 309/936-7468	1972-62-DE & OP 07302001
8.	Peoria	Peoria/Peoria Disposal #1 Peoria Disposal Company 1113 North Swords Avenue Peoria, Illinois 61604	1974-36-DE & OP 14381203
9.	Peoria	Princeville/Akron Land Corporation Akron Landfill Corporation James B. Rock, President Post Office Box 188 Princeville, Illinois 61559	1980-28-DE

	County	Name and Address	Permit Number Site Number
10.	Ogle	Davis Junction/BFI BFI 1827 Walden Office Suite 107 Schaumburg, Illinois 60195	1975-11- DE & OP 14182101
11.	Vermilion	Danville/H & L #2 H & L Disposal Company 301 Adams Building Danville, Illinois 61832	1972-20-DE & OP 18380421
12.	Vermilion	Danville/Thomas Joe Thomas 304 Mayfield Danville, Illinois 61832	1974-44-DE & OP 18380409

Radioactivity in Soil

Following values represent average concentrations for 200 locations in the U.S. from Reference 10.

Radionuclide	Mean Activity (pCi/g)	Absorbed Dose Rate in Air (mrad/yr.)
K-40	12	17
U-238	0.6	8
Th-232	1.0	22

Radioactivity in Building Materials (pCi/gram)

	Material	^{40}K	^{238}U	^{226}Ra	^{232}Th
From Reference 11: (Hamilton, 1971, United Kingdom)	Clay Brick	18	3	1.4	1.2
	Silicate Brick	10	0.2	0.2	0.1
	Granite	30	6	2.4	2.2
	Aerated Granite	19	0.4	2.4	0.4
	Natural Gypsum	4	0.4	0.6	0.2
	Fly Ash	(6-16)	(1-12)	(0-4)	(1.0-1.2)
From Reference 12: (Wollenberg & Smith USA)	Cement	3.4	1.1	-	0.4
	Silica Sand	9	0.3	-	0.5
	Commercial Sand	7	0.3	-	0.3
From Reference 13: (Krisyuk, et al; 1974, USSR)	Red Brick	18	-	1.5	1.0
	Silica Brick	6	-	0.5	0.4
	Light Concrete	14	-	2.0	0.9
	Granite	40	-	3.0	4.5
	Sand	7	-	(<0.4-1.0)	<0.4
	Cement	4	-	0.7	<0.4
From Reference 14: (Kolb, Germany, 1977)	Lime Bricks	0.7-8	-	0.2-0.6	0.2-0.5
	Red Slime Bricks	8-13	-	2.5-6.7	3.9-10
	Other Bricks and Clinkers	4-69	-	0.6-3.1	0.5-3.7
	Pumice Bricks	13-30	-	0.7-3.7	1.1-4.6
	Slag Sand and Sly Bricks	3-16	-	1.2-3.2	0.6-5.6
	Cement	<0.5-7	-	03.-5.3	0.3-5.2
	Natural Gypsum	0.7-5	-	<0.7	<0.5
	Byproduct Gypsum	<0.8-6	-	7-28	<0.5

Note[14]: The NCRP of the USSR has recommended that the specific activity C of building materials not exceed:

$$\frac{C_K}{130\ pCi/g} + \frac{C_{Ra}}{10\ pCi/g} + \frac{C_{Th}}{7\ pCi/g} \leq 1\ pCi/g$$

As an action level such that annual radiation exposure will not exceed 150 mr/yr. due to building materials.

	Material	Radium (pCi/gram)
From Reference 15: (Fitzgerald, 1978)	Chalk Sandstone	0.19-0.60
	Red Brick	2.5-6.7
	Other Bricks and Tiles	0.6-3.1
	Pumice Stone	0.7-3.6
	Slag Sand and Stone	1.2-3.2
	Cement	0.3-5.3
	Natural Plaster	<0.7
	Artificial Plaster	7-28
	Phosphogypsum:	
	Florida	33
	Morocco	25
	Idaho	23
	Concrete (Alum Shale):	
	Old type 1947-1975	35
	New Type 1974	9
	Red Mud (Bricks)	8
	Fly Ash	3-5
	Slag Pumice (Bricks)	6
	Phosphorus Slags - Florida	5-6
	Granite	3

From Reference 16:

Samples of agricultural gypsums from the Florida phosphate fertilizer industry were found to average 15 pCi/gram Radium 226.

From Reference 17:

Table 1: Natural Radioactivity Concentrations in Florida Phosphate Mine Products and Wastes (pCi/gram)

Material	Ra-226	U-238	Th-230	Th-232
Marketable Rock	42	41	42	0.4
Slimes	45	44	48	1.4
Sand Tailings	8	5	4	0.9

Radioactive Materials in Ceramic Glass

Uranium has been used as a coloring agent in glazes and glass since the 18th Century. In 1974 and 1977, a study conducted by Simpson[4] indicated that assuming tableware contained 20% natural uranium in the glaze, dishwashers were receiving whole body doses of 34.4 mrem/yr., waiters 7.93 mrem/yr. and patrons 0.18 mrem/hr.

Radioactivity in Time Pieces for Luninosity

- Early luminous compounds contained 100 uCi Ra/gram of phosphor.[1]
- Watches could contain >1.0 uCi of Ra-226.[1]
- Average population dose for wearers of radioluminous (radium) wristwatches in USA ≈30-40 mrem/yr. to gonads.[2]
- Tritium contained in LCD/LED watches (≈200 mCi/watch) have a diffusion rate which results in dose to the wearer of <500 mrem/yr.[3]

Smoke Detectors

Although Ra-226 was originally used and is still used by a few manufacturers, Am-241 is now the most widely used source. Smoke detectors for use in commercial and industrial properties typically contain 15 uCi of Americum 241. Single units used in homes contain 1 uCi or less of Am-241 or, where used, 0.1 uCi of Ra-226.[5]

Uranium in Dental Porcelain

Uranium salts have been added to porcelain for many years in an attempt to match coloring and fluorescence of natural teeth. A study conducted by the FDA[6] indicated uranium concentrations in the porcelain teeth ranged from <.001 to 0.044 percent. It was calculated that assuming intimate and continuous contact between teeth and oral tissues the dose rate from the α for the highest concentration would be 137 mrem/yr. The dose rate for the more penetrating β particles from the uranium was calculated to be 0.00 to 1.19 rem/yr.

Polonium 210 in Tobacco[7]

Typical concentration in U.S. cigarettes = .4 → .6 pCi/cigarette resulting in average annual dose to basal cells of bronchial epithelium of smokers of 0.05 rads/yr. (compared to 0.01 rads/yr. for non-smokers.

Thorium, Uranium and Daughter Products in Opthalmic Glass[8]

The manufacture of opthalmic glass frequently utilizes mixtures of rare earth and zirconium oxides containing low levels of alpha emitting decay products of thorium and uranium including radium. Some alpha particles of sufficient energy (and beta/gamma energy as well) will traverse the distance between the glass and the corneal germinal cell layer of eye to deposit dose. Measured concentration in samples studied in the ranges of 12-28 dpm/gram Thorium 228 and 12-27 dpm/gram Lead 212. Dose estimation for alpha in the range of .1-.2 rads/yr. and .2-.6 rads/yr. for beta, assuming various dose conversions and Thorium 232 content assumptions.

Spark gap irradiators each containing 1 uCi of Cobalt 60 could result in 12 mrem/yr. to certain categories of the population.[9]

Recycling of uranium contaminated scrap iron could result in up to .6 mr/yr. dose to certain members of population (up to 4×10^{-4} mr/yr. to a housewife using a frying pan made from this material).[9]

Annual dose to campers using incandescent mantles with natural thorium and radium could be in excess of 15 mr/yr.[9]

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16. Guimond, R.J. and Winham, S.T.; Radioactive Distribution in Phosphate Products, By-Products, Effluents and Wastes, U.S. EPA Technical Note ORP/CSO-75-3, 1975

17. Guimond, R.J.; Radiological Aspects of Fertilizer Utilization, U.S. NRC, previously cited, 1978

Mallinckrodt, Inc.

John L. Ufheil
Executive Vice President
Chief Operating Officer

675 McDonnell Blvd.
P.O. Box 5840
St. Louis, MO 63134
(314) 895-2105

December 8, 1981

BJK 12/17/81

Mr. Charles B. Kaiser, Jr.
Executive Director (Acting)
Metropolitan St. Louis Sewer District
2000 Hampton Avenue
St. Louis, Missouri 63139

Dear Mr. Kaiser:

I received your letter of December 3, 1981, concerning radioactive materials at our St. Louis Plant site. I have contacted the appropriate people in our Company to gather the facts regarding this matter so that a meeting can be held as soon as possible. The people that I have asked to look into this matter and to respond to you will not be available to meet with you until the week of December 21.

Please be assured that it is and has always been Mallinckrodt's intention to comply fully with all regulations regarding waste disposal. Nevertheless, we are anxious to meet with you to discuss this matter fully and completely.

Sincerely yours,

John L. Ufheil

John L. Ufheil

JLU:wg

Mallinckrodt, Inc.

675 BROWN RD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-0123

December 1, 1981

BHR 12/3/81

Metropolitan St. Louis Sewer District
10 East Grand
St. Louis, Mo. 63147

Attention: Mr. Bernard A. Rains

Dear Bernie:

As I discussed with you on November 24th., the west sewage treatment pond at Mallinckrodt's St. Louis Plant is clean and ready to be put back into service. Since use of this pond will help insure proper neutralization and equalization of our sewage before discharge to MSD, we would like to begin operating the pond as soon as possible.

The pond has not been used since June, 1980, when Mallinckrodt decided not to flush out accumulated solids because of questions related to residual quantities of Radium 226. Since that time the majority of the solids have either decomposed (over 80% of the material is organic) or have been eroded into MSD's sewer by rainfall. More recently some of the material was drummed out and some was flushed to the sewer to permit repairs of the lateral pipes in the pond and to the bottom valve. Finally, on the weekend of November 21, 1981, the last residues in the pond were flushed into the MSD sewer.

We are satisfied this situation has not resulted in any violation of applicable laws or regulations or any threat to human health or the environment. We hope it will not jeopardize the longstanding, cooperative relationship between Mallinckrodt and MSD.

Sincerely,

Noble Robinson

/bd

Noble Robinson,
Director, Environmental Affairs

Mallinckrodt®

Mallinckrodt, Inc.

675 BROWN RD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-0123

October 24, 1980

10/27/80

Mr. Bernard A. Rains,
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand
St. Louis, Mo. 63147

Dear Bernie:

Mallinckrodt proposes to discharge the solids in our west wastewater basin in a manner that should cause no problem for the Metropolitan Sewer District. We have collected a representative sample of these solids, and this composite sample has been analyzed for residual $Radium_{226}$. Based on that analysis, we believe the solids can be discharged to the MSD sewer over a 100-day period and contribute less than 1 pCi/gram additional $Radium_{226}$ in the Bissell Point incinerator ash. A recent analysis of that ash indicates a concentration of 3.2 ± 1.0 pCi/gram $Radium_{226}$. Given that analysis, Mallinckrodt's planned cleanout of the west basin should result in ash containing less than 5 pCi/gram $Radium_{226}$.

The plan for cleaning the basin involves dividing it into 100 pie shaped segments of equal solids volume (See the attached sketch). These pie shaped segments will be controlled by stretching ropes or markers across the basin. The solids will be flushed with a fire hose from the outer perimeter towards the center drain. Past history indicates that the solids should be rigid enough to prevent subsidence, so the daily control of the solids to be flushed should be accurate. This procedure will be supervised daily, and the amount of solids removed will be audited and recorded daily.

As agreed in our meeting, Mallinckrodt will reimburse MSD for the analysis of $Radium_{226}$ in monthly composite samples of incinerator ash during the months September, 1980 through the conclusion of the west basin cleanout.

Mallinckrodt believes this action complies with all applicable laws and regulations. Further, we believe the discharge of such minimal quantities of $Radium_{226}$ into the sewer poses no threat to human health or the environment. Unless we hear to the contrary from MSD, we intend to begin this action November 3, 1980.

Sincerely,

Noble Robinson

Noble Robinson,
Director, Environmental Affairs

/bd
Attach.

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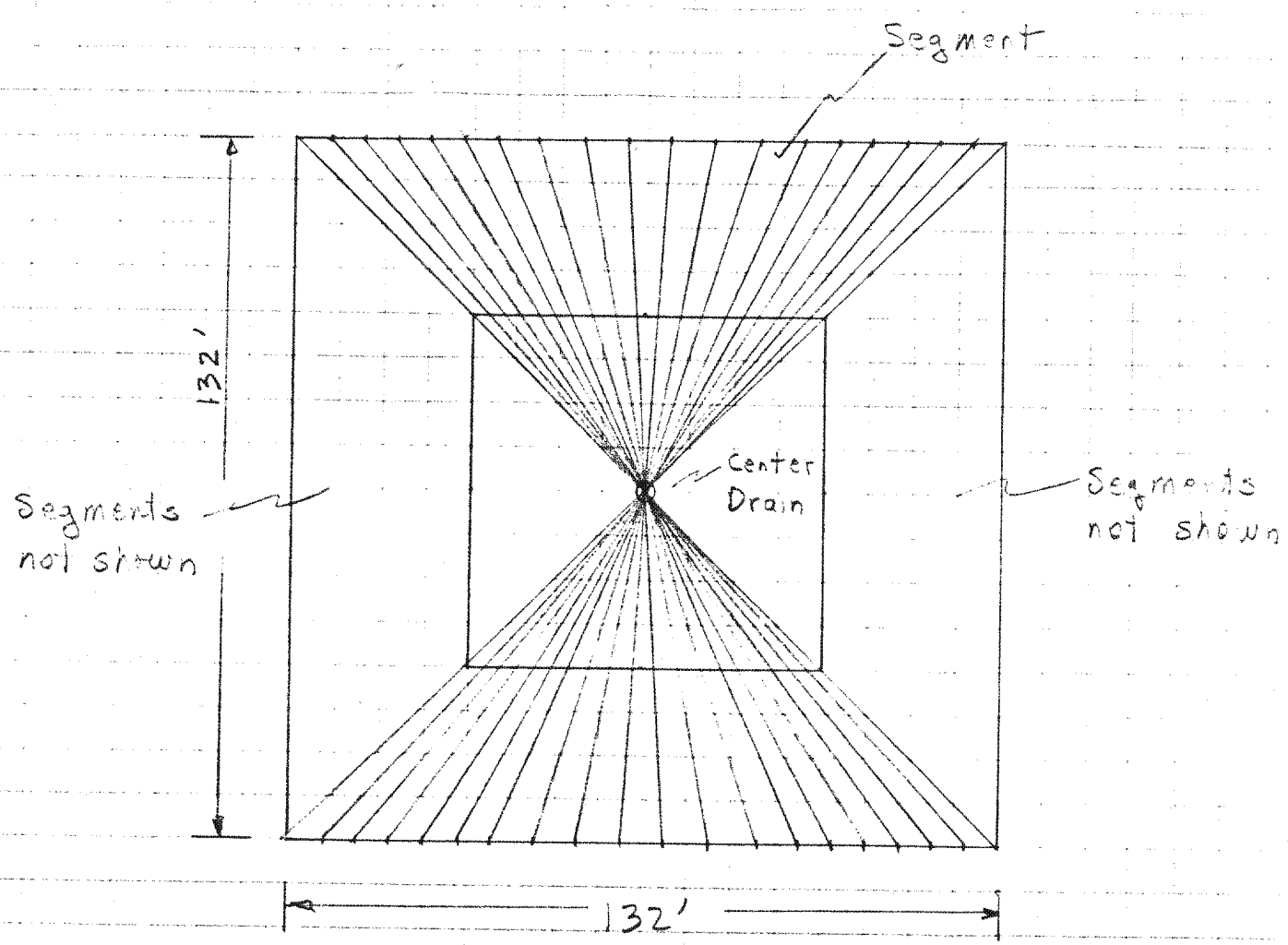
10/10/3?
CJ

Figure 1

West Wastewater Basin Showing Segment Divisions for Solids Disposal



Note: Segments are not drawn to scale

Mallinckrodt, Inc.

675 BROWN RD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-0123

November 10, 1980

Mr. Bernard A. Rains
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand
St.Louis, Mo. 63147

BAR 11/10/80

Dear Bernie:

In response to your questions of November 6, 1980, Mallinckrodt submits the following back-up information regarding our plan for disposal of sludge in the west wastewater treatment pond:

1. The volume of the sludge was measured by personnel from our Drafting Department using linear measurement techniques. Their calculations are detailed in Mallinckrodt Drawing #4307-203-1. A copy of this drawing is attached.

2. The west wastewater pond was sampled on August 4, 1980, using a protocol detailed in the attached letter from Mr. Craig Johler to myself, dated August 19, 1980. A composite sample from this procedure was analyzed for dry solids, and the density was found to be 1.46 pounds of dry solids per gallon of sludge. The total weight of dry solids was calculated to be 160,404 lbs.

3. A composite sample was analyzed by NUS Corp. for various radioactive materials, with the following results:

Uranium:	200 ± 50 pCi/gram
Thorium:	80 ± 16 pCi/gram
$Radium_{226}$	62 ± 2 pCi/gram

The analysis for $Radium_{226}$ was corroborated by a separate analysis by General Atomic Corp. of 67 pCi/gram. Based on these data, and the total weight of material in the pond, the total activity contained in the sludge was calculated to be 0.015 ± 0.004 curies of Uranium; 0.0059 ± 0.0012 curies of Thorium; and 0.0046 ± 0.0001 curies of $Radium_{226}$.

4. At Mallinckrodt's request, Dr. Morton I. Goldman of NUS Corp. calculated that the discharge of all solids in the pond in one day would yield about 100 pCi $Radium_{226}$/gram of Bissell Point incinerator ash. Alternatively, discharge of the solids over 100 days would result in an incremental $Radium_{226}$ concentration in the incinerator ash of 1 pCi/g. This calculation was based on an inventory of 4.6×10^9 pCi in the pond and an average daily ash production at Bissell Point of 4.5×10^7 grams per day.

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5. I outlined in my letter to you of October 24, 1980, Mallinckrodt's plan for supervisory control of the discharge equally over 100 days. Attached to that letter was a drawing illustrating the planned method of incremental discharge. That drawing was part of a letter from Mr. Craig Johler to me, dated October 16, 1980, that is attached. This letter further describes Mallinckrodt's consideration of a suitable method for controlled discharge.

I hope this information will enable MSD to evaluate our discharge plan.

Sincerely,

MALLINCKRODT, INC.

S. N. Robinson
Director, Environmental Affairs

/bd
Attach.

MALLINCKRODT, INC.

ST. LOUIS.

October 16, 1980

TO: Mr. N. Robinson

RE: Disposal of Solids from West Wastewater Basin

As a means of disposing of the solids in the west wastewater basin, it has been proposed that these solids be discharged to MSD in equal daily increments over a period of 100 days. A method for achieving this disposal is outlined below.

Roger Johnsen has suggested that the west basin solids be divided into 100 pie-shaped segments of equal solids volume. The segments would run from the basin center drain to the basin perimeter. The width of each one of these segments would increase in proportion to the distance from the basin center drain. Thus the segments would be narrowest at the center of basin and widest at the basin perimeter (see attached sketch). Since the pond has a square shape, all segments will not have the same shape (i.e. segments at the corners would be longer and narrower than segments close to the midpoint of the sides). The average width of a segment at the perimeter would be five feet.

The procedure for disposing of these segments is based on previous techniques for removal of solids from the wastewater basins. Utilities personnel have traditionally flushed solids from the basin by using a fire hose. Usually the solids are flushed from the basin perimeter down to the basin center drain in large segments of various widths. The personnel involved slowly work their way around the basin, segment by segment, until all the solids have been removed from the basin. This method also insures that a large accumulation of solids does not occur around the center drain and subsequently create a pluggage problem.

To accurately remove a given volume of solids each day by segments, the solids accumulated in the basins would have to be rigid enough to prevent sliding and slipping of solids from adjacent segments into the segmental area being flushed. Past history indicates that these solids normally have a good rigidity. Also, the west basin has been drained of liquid for several months and the solid residues have air dried appreciably. Assuming the 100 day period will begin shortly, the colder winter temperatures should increase the viscosity of the sludge.

Incremental solids removal would be carefully controlled by stretching ropes or markers across the basin to mark the segment of solids to be removed. The markers would be repositioned each day with supervisional assistance and the quantity of solids removed would be checked and audited each day.

Other methods of solids disposal have been considered. Various sand or mud pumps would probably necessitate use of water to slurry or break-up solids before pumping. With no means to properly contain the slurry, solids and water will escape to other parts of the basin before pumping. Pumping the solids out to a metering tank or pumping for a set time period would not be useful if the water to solids ratio varies significantly. The only exact measurement of solids removal would finally come down to removal of a given segment or section of solids each day, which is no different than the above proposed method of flushing.

Craig Johler

cc: Mr. W. Copenhaver
Mr. E. Monaco

AK - 14170 - R 2/74

MALLINCKRODT, INC.
ST. LOUIS.

Dalton

RECEIVED

AUG 22 1980

MALLINCKRODT, INC.
ENVIRONMENTAL AFFAIRS
S. N. ROBINSON

August 19, 1980

TO: Mr. N. Robinson

SUBJECT: Sampling of West Wastewater Pond Sludge

On August 4, 1980, sludge from the west wastewater pond was sampled. The samples were composited on a pond sludge volume basis as follows:

Sample Point Location (see attached sketch)	Number of Samples Taken	% of Pond Sludge Volume Represented	Method of Sampling
1. 15 ft. circle with center at center of pond.	4	60%	Core
2. 30 ft. circle with center at center of pond.	4		Core
3. Pond corners	4	30%	Scoop
4. Pond side walls	8	10%	Scoop

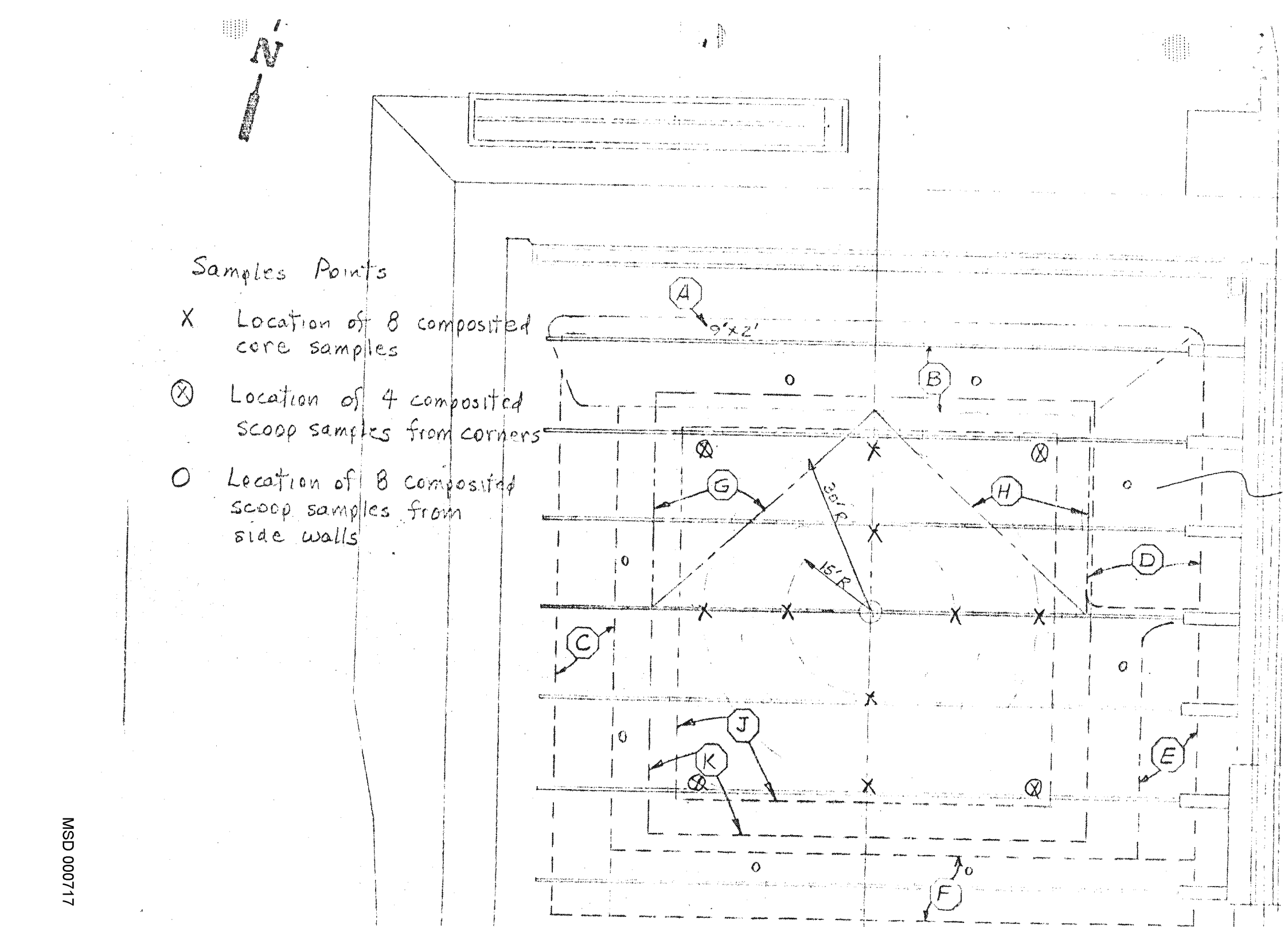
The total sample volume from sample points No. 1 and No. 2 was 4400 mls. This volume was combined with 2200 mls. from the point No. 3 and 733 mls. from Point No. 4. The entire sample was dried at 70° C to reduce volume and then further dried at 105° C in a forced air dryer. The total remaining dry weight was 1284 g. from a total sample volume of 7333 mls. or 1.46 lb. of dry solid per gallon of pond sludge volume. The dried solids were reduced in size and passed through a 20 mesh screen; the measured bulk density was 0.57 g/ml.

Based on an estimated 109,866 gallons of sludge currently in the west pond, the total dry weight in the pond is 160,404 lbs. or approximately 80 tons of dry solids.

Craig Johler

cc: Mr. G. Brown
Mr. T. Byrd
Mr. E. Monaco

MK - 14170 B 2 74


N
Samples Points
X Location of 8 composited core samples
⊗ Location of 4 composited scoop samples from corners
O Location of 8 composited scoop samples from side walls
A
9'x2'
B
G
H
D
C
J
K
E
F
30' R
15' R

4307-701-1	WASTE TREAT. PLANT PLAN & DET.
DWG. NO.	TITLE

REFERENCE DRAWINGS

ENGRG. JOB NO. 0125	PROJECT NO.

REV. NO.	DATE	REVISIONS

MALLINCKRODT, INC.

ST. LOUIS, MO.

WASTE TREATMENT POND SURVEY VOLUME OF SLUDGE

PLANT 7	BLDG.	FLOOR
SCALE AS MARKED	DATE 7-24-80	
DR. R JONES	CHKD. J P DUNCAN	
TR.		

DRAWING NO. 4307-203-1 REV. 0

FOR BIDS	ISSUED FOR CONST.

VOLUME OF SLUDGE WEST BASIN JULY 1990

AREA	DEPTH FT.		AVG. WIDTH FT.		AVG. LENGTH FT.	VOLUME CU. FT.
(A)	.75	X	2	X	115 /2	86
(B)	.33	X	12	X	105	415
(C)	.08	X	10	X	90	72
(D)	.5	X	20	X	44	440
(E)	.08	X	10	X	42	34
(F)	.08	X	12	X	104	100
(G)	.166	X	36	X	36 /2	107
(H)	.25	X	36	X	36 /2	162
(J)	2	X	66	X	66 /3	2904
(K)	2	X	72	X	72	10,368

TOTAL = 14,688 C

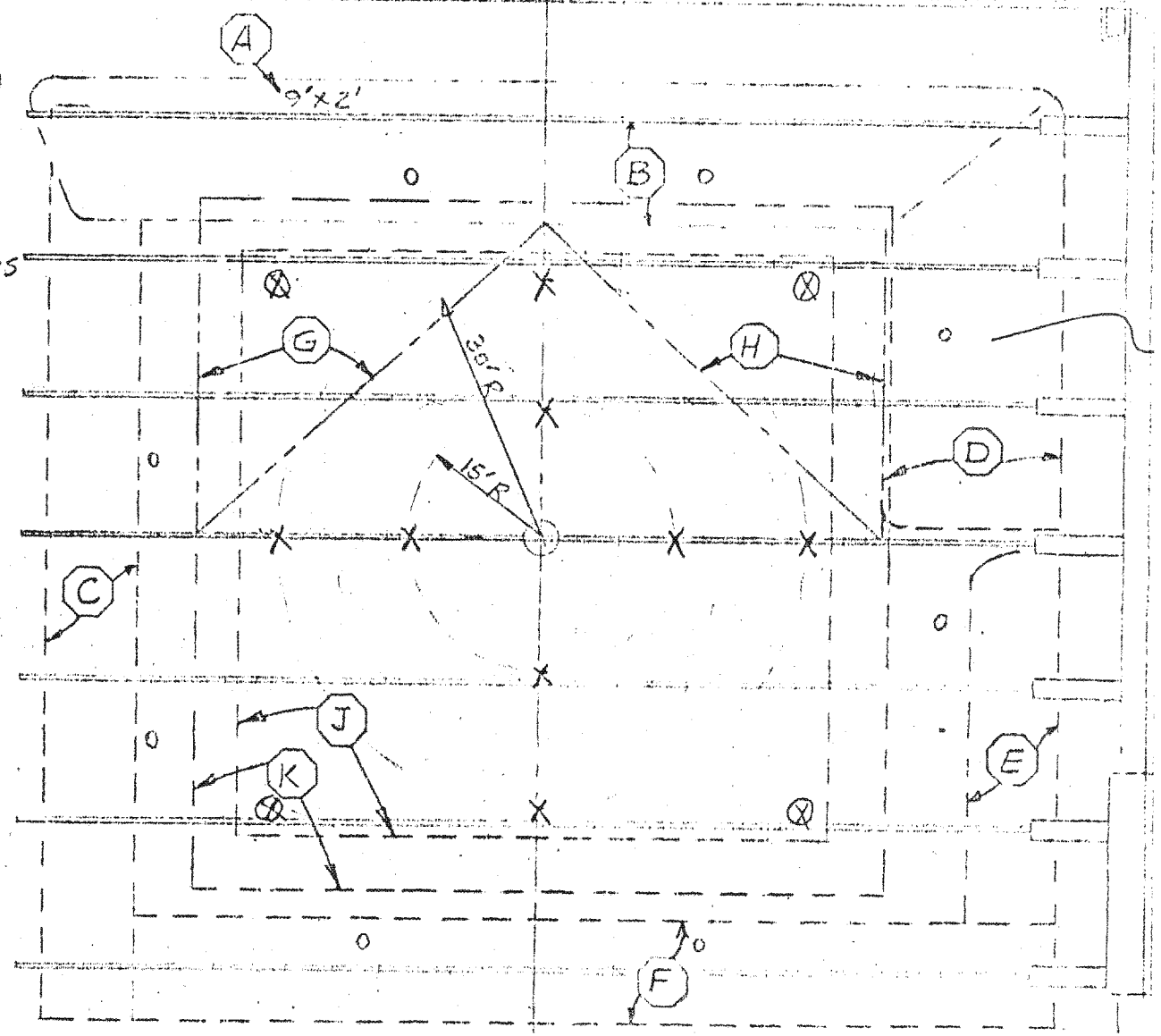
TOTAL = 109,866 G

Samples Points

X Location of 8 composited core samples

⊗ Location of 4 composited scoop samples from corners

O Location of 8 composited scoop samples from side walls



Mallinckrodt, Inc.

675 BROWN RD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-0123

November 18, 1980

Mr. Bernard A. Raines
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand
St. Louis, MO 63147

BAK 11/19/80

Dear Bernie:

At our meeting on November 6, you asked whether MSD incinerator ash at the Bissell Point Plant would qualify as "hazardous waste" because of the Radium 226 content of the ash. We indicated to MSD at that meeting that it was Mallinckrodt's view that the ash did not qualify as "hazardous waste" because of its Radium 226 content. So far as this Company is aware, the ash in question could be classified as "hazardous waste" because of its Radium 226 content only pursuant to (1) the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§6901 et seq. and associated regulations or (2) the Missouri Hazardous Waste Management Law, Mo. Rev. Stat. §§260.350 et seq. and associated regulations. As explained more fully in this letter, it is this Company's belief that the ash is not "hazardous waste" because of its Radium 226 content under either of these statutes. However, I suggest that MSD independently develop and prepare its own legal opinion on this issue.

RCRA nowhere provides that a given quantity of radium renders a waste material "hazardous". One must examine the regulations to ascertain whether Radium 226 content of a waste might cause the waste to be categorized as "hazardous". The U.S. Environmental Protection Agency recently promulgated extensive regulations to implement RCRA. See 45 Fed. Reg. 33063-33285 (May 19, 1980). Part 261 of the regulations, effective November 19, 1980 and titled "Identification and Listing of Hazardous Waste", establishes two procedures by which a waste may be deemed "hazardous". One procedure, Subpart C of Part 261, includes the so-called characteristics of hazardous waste determinations. The characteristics include ignitability, corrosivity, reactivity and EP toxicity. Not one of the four characteristics tests applies so as to render MSD ash "hazardous" solely because of its Radium 226 content. The other procedure, Sub-part D of Part 261, includes the lists of hazardous wastes. The lists refer to hazardous wastes from nonspecific sources, hazardous wastes from specific sources and discarded commercial chemical products and associated off-specification materials, containers and spill residues. Not one of the lists pertains to the ash generated by

MSD merely because of its Radium 226 content. In addition, on July 16, 1980, (45 Fed. Reg. pp. 47832-47834) the USEPA promulgated an interim final rule to amend sub-part D of Part 261 to add 18 sources of wastes to its initial list of "hazardous wastes". Not one of the 18 additional sources of wastes which by regulation become "hazardous wastes" on January 16, 1981 pertains to the ash generated by MSD merely because of its Radium 226 content.

As is the case with RCRA, the Missouri Hazardous Waste Management Law (MHWML) does not expressly define a waste as "hazardous" because of a given radium content. One must examine the regulations implementing MHWML which became effective January 1, 1980 (10 CSR 25-4.010) to ascertain whether Radium 226 content causes a waste to be categorized as "hazardous". The MHWML regulations similar to the RCRA regulations establish four characteristics categories--ignitability, corrosivity, reactivity and toxicity [10 CSR 25-4.010(2)-(5)]. Not one of the characteristics applies so as to render MSD ash "hazardous". In addition, the Missouri regulations establish a list of 35 specific wastes [10 CSR 25-4.010(6)(B)] and a list of 126 specific processes [10 CSR 25-4.010(6)(C)] that are deemed to generate hazardous waste. Radium 226 is not one of the 35 wastes listed. Furthermore, the list of 126 processes that are deemed to generate "hazardous wastes" does not include the sludge incineration process performed at the MSD Bissell Point Plant or the columbium/tantalum extraction process operated by this Company. The only reference to Radium 226 in the MHWML regulations is the one that occurs at 10 C.S.R. 25-4.010(7)(A)5. That portion of the regulations provides a method for a generator of "hazardous waste" to delist certain wastes which were deemed to be "hazardous" either because of their characteristics, the fact that the wastes were listed or the fact that those wastes were generated from one of the listed processes. Since the MSD ash was not "hazardous" because of any one of the three previously mentioned MHWML regulatory provisions, the delisting feature of 10 CSR 25-4.010(7)(A)(5)] has no applicability to the ash either.

I trust that this letter satisfies your request for Mallinckrodt's views on this matter.

Very truly yours,

William A. Erdman

William A. Erdman
Attorney

WAE:de

cc: Charles B. Kaiser, Jr.

Mallinckrodt, Inc.

675 BROWN RD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-0123

June 5, 1981

BNL 6/5/81

Mr. Bernard A. Rains
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand
St. Louis,Mo. 63147

Dear Bernie:

You have asked Mallinckrodt to provide MSD with evidence that unreacted ore (URO) discharged from our Columbium-Tantalum operation is "dispersible".

URO that may be discharged to the sewer (e.g. from washing operations) has an average particle size on the order of 5 microns. We routinely grind the ore fed to the C-T Plant in ball mills and analyze the particle size distribution of the product. I have no doubts regarding the dispersibility of such fine particles.

The sludge that settles in our waste ponds contains some residual radioactivity, and it is valid to question its dispersibility, too. Our consultant, NUS, conducted simple settling tests on this sludge and concluded it is probably dispersible under normal sewer flow conditions. More specifically, NUS resuspended the sludge and found that a fraction of it settled with an apparent velocity on the order of a few feet per minute, with most of the rest of the sludge remaining suspended for much longer times. Since sewer design is typically based on minimum flow velocities of 2-3 feet per second to prevent settling of solids, they felt there was a sufficient safety factor in this assessment to conclude the sludge was dispersible.

Sincerely,

Noble Robinson

/bd

Noble Robinson,
Director, Environmental Affairs

Mallinckrodt

MEMORANDUM

Issue: Is the Metropolitan Sewer District of St. Louis (MSD) subject to regulation by the Missouri Department of Social Services, Division of Health because of the radioactive nature of certain discharges to MSD sewers even though those discharges are made in accordance with licenses issued by the Nuclear Regulatory Commission (NRC)?

Conclusion: No. It seems that the Missouri regulations were never intended to require a license of a sewer district that receives radioactive material pursuant to discharges permissible under federal regulation. To the extent that the Missouri regulations attempt to regulate the radiological health and safety aspects of the permitted radioactive discharges from NRC licenses those regulations are preempted.

Discussion: The Division of Health is empowered by Missouri statute to regulate radiological health and safety hazards posed by radioactive materials. See Mo.Ann. Stat. § 192.400 et seq. The statute is on its face broadly applicable to all sources of radiation. However, it and the regulations under it clearly establish a system of regulation that duplicates that of the Atomic Energy Act. As such, the statute is preempted insofar as it would be applicable to material or facilities regulated by NRC. See, e.g., Northern States Power Company v. State of Minnesota, 447 F.2d 1143, 1150 (8th Cir.

1971), 1150 (8th Cir. 1971), aff'd mem., Minnesota v. Northern Pacific Legal Foundation v. State Energy Resources Conversation & Development Commission, 489 F.Supp. 699 (E.D. Cal 1980); Van Dissel v. Jersey Central P&L Co., 152 N.J. 391, 377 A.2d 1244, 1248 (1977); and State ex rel Utility Consumers Council v. Public Service Commission, 562 S.W.2d 688, 698 and 699, cert. denied, 439 U.S. 866 (1978). This concept of preemption is firmly established in case law. Furthermore, since Missouri has not entered into an agreement with the NRC, the state is without authority to license or regulate NRC "licensed material" from the standpoint of radiological health and safety. See. 10 CFR §8.4(j) (interpretation by AEC general counsel).

The Division of Health does appear to recognize, although in a rather obscure fashion, that it cannot regulate material regulated by NRC. 13 C.S.R. 50-90.020(1)(E) rather ambiguously exempts from state regulation.

> "The use of radioactive sources licensed by the U.S. Nuclear Regulatory Commission to installations in the State of Missouri."[1]

[1]The regulations define "source" as a "radiation machine or a quantity of radioactive materials." 13 C.S.R. 50-90.010(17).

On its face this provision exempts from regulation by the Division of Health any "use" of licensed material. The regulations do not define "use." However, they define "user" as any person "having administrative control over one or more sources." 13 C.S.R. 50-90.010(32). By the logical extension of this definition, the exemption applies to any person with administrative control over licensed materials. This arguably includes MSD. In any event, it should be noted that the Missouri regulation, in parallel with the NRC regulations, permits disposal of radioactive material by sewer. 13 C.S.R. § 50-90.090(4). It is unlikely that the Missouri regulations were ever intended to require a license of a sewer district which receives radioactive material pursuant to releases permissible under either federal or state regulations.

Mallinckrodt, Inc.

675 BROWN RD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-0123

July 17, 1981

Mr. Bernard A. Rains
Metropolitan St. Louis Sewer District
10 East Grand
St. Louis, Mo. 63147

7/20/81

Dear Bernie:

Mallinckrodt, Inc. has accumulated approximately 160,000 dry pounds (14,700 cubic feet wet) of material in the west waste treatment pond at its St. Louis Plant. This material contains 4.6×10^9 pCi Radium-226, discharged from the production of columbium and tantalum compounds. We would like to discharge this waste in a controlled manner to the Bissell Point Plant of MSD beginning immediately and continuing through September, 1981. During this period, feed materials of low radioactivity will be processed in the Columbium-Tantalum Plant. The unreacted ore from these operations will continue to be isolated and disposed of without discharge to the sewer, so we predict a discharge of soluble Radium-226 to the sewer that will be equivalent to only .4 pCi Radium-226 per gram of Bissell Point incinerator ash. We propose to discharge the material from the west pond so that it will contribute an average of 2 pCi per gram Radium-226 to the ash. These contributions, plus a normal background level of approximately 1.5 pCi Radium-226 per gram ash should provide a final level of approximately 4 pCi Ra-226 per gram of ash, a level substantially less than 5 pCi Ra-226 per gram.

We propose to control daily discharges of the sludge by setting up temporary tankage that will permit preparation of a slurry of part of the contents of the west pond. The solids concentration in the slurry will be measured and, based on this concentration, a defined number of gallons representing the equivalent of 2 pCi Radium-226 per gram of ash will be released to the sewer per day. Appropriate records will be kept to document the disposal.

Mallinckrodt understands that this action will impose potential additional costs to MSD for sampling, analysis, and other engineering and administrative surveillance. We are willing to pay a reasonable special fee for this disposal, to be negotiated with your office.

Mallinckrodt has recently audited its Columbium-Tantalum operations to ensure compliance with all aspects of our NRC license and applicable NRC regulations. This was done both with internal specialists and outside consultants. In our opinion, our discharges of wastes from the Columbium-Tantalum operation to the sewers of the Metropolitan Sewer District are in full compliance with our license, NRC regulations, and rules of the Missouri Department of Health and the Missouri Department of Natural Resources.

We believe that our proposed disposal action will not contribute any problem related to Radium-226 for MSD in its subsequent handling of this incinerator ash. It is the least costly method of disposal of the material that our engineering studies have been able to identify. It will, of course, return the west pond to its normal function in the pretreatment of Mallinckrodt's waste discharges to MSD.

Mallinckrodt®

I believe this letter responds to your questions.

Sincerely,

MALLINCKRODT, INC.

Noble Robinson

/bd

Noble Robinson,
Director, Environmental Affairs

11/24/81

11/24/81

11/24/81

11/24/81

METROPOLITAN ST. LOUIS SEWER DISTRICT

July 26, 1983

Teledyne Isotopes
Attn: Dr. David Martin
50 Van Buren
Westwood, New Jersey 07675

Dear Dr. Martin:

We have mailed an ash sample to your laboratory for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period June 1 through 30, 1983. The simulated ash composite sample weighs 219 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 83-446 is used in reporting. Please bill and report the results to Mr. B. A. Rains, Pollution Control Manager, at the address below.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

BAR 7/29/83

10 EAST GRAND AVENUE • ST. LOUIS, MISSOURI 63147 • CENTRAL 1-1950

Radiation Management.

METROPOLITAN ST. LOUIS SEWER DISTRICT

June 28, 1983

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period May 1 through 31, 1983. The simulated ash composite sample weights 209 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 6231 is used in reporting.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

May 20, 1983

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcesl Service today.

The sample is a Bissell Point simulated ash composite for the period April 1 through 30, 1983. The simulated ash composite sample weights 207 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No.5656 is used in reporting.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

April 22, 1983

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period March 1 through 31, 1983. The simulated ash composite sample weighs 209 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 5309 is used in reporting.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

GJF 4/26/83

METROPOLITAN ST. LOUIS SEWER DISTRICT

March 4,1983

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed five additional ash samples to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

The samples are Bissell Point STP simulated ash composites for the periods indicated and two ashed Mallinckrodt settling pond composites. It might be helpful in maintaining sample identification if our MSD Lab No. was used in reporting results.

MSD Lab No.	Composite Period	Source	Approx Wt.
3541	Dec. 1 through 31, 1982	B.P. STP Sim. Ash	208 grams
4335	Jan. 1 through 31, 1983	B.P. STP Sim. Ash	207 grams
4336	Feb. 1 through 28, 1983	B.P. STP Sim. Ash	210 grams
4189	Collected 1/7/83 & Composited 2/23/81 - East Pond - Mallinckrodt		82 grams
4190	Collected 1/7/83 & Composited 2/23/81 - West Pond - Mallinckrodt		91 grams

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
Steve Weis
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

December 30, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period November through November 30, 1982. The simulated ash composite sample weighs 208 grams and was prepared by lab-firing filter cake at 580°C. It might e helpful in maintaining sample identification if our MSD Lab No.3109 is used in reporting.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

November 23, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period October 1 through October 31, 1982. The simulated ash composite sample weighs 208 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 2312 is used in reporting.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

11/30/82

METROPOLITAN ST. LOUIS SEWER DISTRICT

September 18, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period September 1 through September 30, 1982. The simulated ash composite sample weighs 208 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 1684 is used in reporting.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

September ~~16~~ 20, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period August 1 through August 31, 1982. The simulated ash composite sample weighs ~~230~~ 225 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 1441 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

FILE UNDER RMC

METROPOLITAN ST. LOUIS SEWER DISTRICT

August 9, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed two additional ash samples to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

The samples are Bissell Point simulated ash composites for the periods of June 1 through June 30, 1982 and July 1 through July 31, 1982. The simulated ash composites weigh around 200 grams each and were prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if the results for June are reported under our MSD Lab No. 741 and the results for July are reported under our MSD Lab No. 742.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains ✓ BAR 8/10/82
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

June 14, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period May 1 through May 31, 1982. The simulated ash composite sample weighs 230 grams and was prepared by lab-firing filter cake at 580 C. It might be helpful in maintaining sample identification if our MSD Lab No. 6135 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains ✓ 6/21/82
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

May 13, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period April 1 through April 30, 1982. The simulated ash composite sample weighs 230 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 5656 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

April 12, 1982

BJK 4/26/82

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period March 1 through March 31 , 1982. The simulated ash composite sample weighs 230 grams and was prepared by lab-firing filter cake at 580 C. It might be helpful in maintaining sample identification if our MSD Lab No. 4882 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains ✓
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

March 9, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period February 1 through February 28, 1982. The simulated ash composite sample weighs 211 grams and was prepared by lab-firing filter cake at 580 C. It might be helpful in maintaining sample identification if our MSD Lab No. 4104 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

BAR 3/19/82

March 8, 1982

Bernie,

Please prepare a letter of agreement and also a letter thanking them for their cooperation.

Thanks.

Chuck

letter received from Mallinckrodt March 25, 1982

METROPOLITAN ST. LOUIS SEWER DISTRICT

February 11, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period January 1 through January 31, 1982. The simulated ash composite sample weighs about 200 grams and was prepared by lab-firing filter cake at 580°C. it might be helpful in maintaining sample identification if our MSD Lab No. 3511 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains ✓ BAR 2/16/82
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

February 5, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample (about 400 grams) is a Bissell Point Ash Basin #2 composite from twenty-seven samples collected over the period of November 25, 1981 through January 7, 1982. The samples were collected at random locations from working face cross-sections throughout the basin as the ash was being removed. It might be helpful in maintaining sample identification if our MSD Lab No. 3411 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
I.W. Lab Supervisor

LG:kat

cc: B. A. Rains ltr 2/11/82
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

January 13, 1982

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure.* The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period December 1 through December 31, 1981. The simulated ash composite sample weighs about 200 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No 3047 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leb Groseclose
I.W. Lab Supervisor

LG:kat

1/15/82

cc: B. A. Rains ✓
George Schillinger

* Note - I have been advised by Mr. Rains that the cost for this analysis has been increased to $70.00. It is understood that this and future samples will be charged at that rate.

Mallinckrodt Meeting 12/21/81

re: charges for Rad solids

Jack Ufheil
Ed Fake
Mac Nickles
Bill Erdman
Noble Robinson

1. have drums of material to haul to Nevada
2. still has soluble material discharged
3. Oct. 23 FR re: radium

copy of 12/21/81 memo given to Mallinckrodt

SUMMARY

ASH BASIN OPERATION DATA

Bissell Point Treatment Plant

August 25, 1980

1. Periods of Use

May, 1970 to 1973	Fill - Ash Basin No. 2
1973 to March, 1977	Fill - Ash Basin No. 1
March, 1977 to March, 1980	Fill - Ash Basin No. 2
January, 1980	Fill - Ash Basin No. 1

2. Removal Schedule

Ash Basin No. 2
Material hauled to Stein Dump on Halls Street by Fred Weber.
61,000 yards - Spring and Summer, 1975
22,161 - Spring, 1976
83,161 yards - Total

Ash Basin No. 1
Material hauled to District property on Angelica Street by Casper & Sons.
61,040 yards - December, 1979 and January, 1980

Ash Basin No. 2
Approximately 80,000 yards - Ready for Removal.

INDUSTRIAL WASTE
JUNE 1981
FINAL REPORT FISCAL YEAR 1980-81

AW file.

ACCOUNT NUMBER	EXPENDITURES THIS MONTH	EXPENDITURES YEAR TO DATE	ENCUMBERED P. O.'s	UNENCUMBERED BALANCE	PERCENT EXPENDED*
PAYROLL					
101	39,606.90	497,272.16	----	-25,172.16	100
OPERATING EXPENSE MATERIAL & SERVICE					
201	----	----	----	----	--
202	----	----	----	----	--
203	----	2,481.82	----	- 2,081.82	100
204	----	----	----	----	--
205	35.96	482.90	----	- 272.90	100
206	----	----	----	----	--
207	----	625.19	----	- 115.19	100
208	20.38	158.50	----	241.50	40
209	----	----	----	180.00	0
210	4,004.64	10,497.90	----	902.10	92
211	----	----	----	----	--
212	1,471.87	17,859.70	664.80	8,475.50	69
215	----	----	----	----	--
216	----	----	----	----	--
217	----	232.10	----	- 132.10	100
218	----	----	----	----	--
220	----	----	----	----	--
221	1,050.00	16,053.27	----	- 2,453.27	100
223	----	----	----	100.00	0
240	67.53	276.34	----	- 76.34	100
TOTAL	6,650.38	48,667.72	664.80	4,767.48	91
OPERATING EXPENSE BUILDINGS & PLANTS					
301	----	----	----	----	--
302	----	----	----	----	--
TOTAL	----	----	----	----	--
ADM. & GEN. EXPENSE					
401	----	2,429.59	----	- 1,629.59	100
402	----	----	----	100.00	0
403	72.84	997.80	----	2.20	99
407	----	----	----	----	--
409	----	92.20	----	- 92.20	100
410	205.94	600.02	----	399.98	60
411	----	211.00	----	29.00	88
412	----	284.32	----	- 84.32	100
415	53.26	1,196.81	----	- 696.81	100
444	----	----	----	----	--
431	340.00	10,703.76	----	- 703.76	100
TOTAL	672.04	16,515.50	----	- 2,675.50	100
CAPITAL OUTLAY					

INDUSTRIAL WASTE

NOVEMBER, 1981

IW Division

ACCOUNT NUMBER	EXPENDITURES THIS MONTH	EXPENDITURES YEAR TO DATE	ENCUMBERED P. O.'s	UNENCUMBERED BALANCE	PERCENT EXPENDED
PAYROLL					
101	41,922.39	229,589.77	----	365,152.23	39
OPERATING EXPENSE MATERIAL & SERVICE					
203	69.98	69.98	----	1,730.02	4
205	----	9.11	----	190.89	5
207	28.27	38.65	----	261.35	13
208	----	28.34	----	- 28.34	100 +
210	560.87	1,384.79	2,686.70	7,328.51	36
212	571.20	5,290.04	427.01	22,282.95	20
217	----	8.20	----	191.80	4
221	1,050.00	5,250.00	----	7,350.00	42
223	----	----	----	100.00	0
240	1.68	226.79	----	- 26.79	100 +
TOTAL	2,282.00	12,305.90	3,113.71	39,380.39	28
ADM. & GEN. EXPENSE					
401	----	100.50	----	899.50	10
403	16.92	326.47	----	673.53	33
410	286.88	1,087.91	----	412.09	73
411	----	----	----	250.00	0
412	----	5.31	----	194.69	3
415	90.98	90.98	----	409.02	18
431	100.00	1,629.25	----	- 1,692.25	100 +
TOTAL	494.78	3,240.42	----	1,146.55	73
CAPITAL OUTLAY					
506	----	----	9,000.00	-0-	100
508	----	----	----	15,580.00	0
TOTAL	----	----	9,000.00	15,580.00	37

12/18/81

METROPOLITAN ST. LOUIS SEWER DISTRICT

December 15, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

GK 11/17/81

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for rush analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period November 1 through November 30, 1981. The simulated ash composite sample weighs about 200 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 2708 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:nm

cc: B.A. Rains
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

November 6, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed two additional ash samples to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

The samples are Bissell Point STP simulated ash composites for the periods indicated. It might be helpful in maintaining sample identification if our MSD Lab No. was used in reporting results.

MSD Lab No.	Composite Period	Approx. Wt.
2133	Sept. 1 through 30, 1981	200 grams
2134	Oct. 1 through 31, 1981	200 grams

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
Steve Weis
George Schillinger

11/12/81

METROPOLITAN ST. LOUIS SEWER DISTRICT

MSD

December 3, 1981

Mr. J. L. Efheil
Executive Vice President
Chief Operating Officer
Mallinckrodt, Inc.
P. O. Box 5840
St. Louis, MO 63134

Dear Mr. Efheil:

Since July 28, 1980, our Industrial Waste Division and Wastewater Management personnel have been conferring routinely with representatives of your company concerning the ultimate disposition of radioactive materials discharged to the sewer from your St. Louis Plant's Columbium and Tantalum process. To evaluate the extent of Radium 226 contamination of our incinerator ash, we have expended considerable funds for radiation consultant testing and advice and for our own technical and managerial staff evaluations. We have just recently signed a contract to remove the ash from our property to an environmentally acceptable location. Transport to this location has increased our disposal costs substantially.

While we were investigating the situation your company created, we requested that your plant's west wastewater equalization basin, which contained additional low level radioactive material, not be discharged to the public sewer system. Your representatives agreed to this. Unfortunately, on November 24, 1981, we received notification that our agreement had not been honored and the material, for reasons unknown to us, has been discharged to the public sewer system and now is in a previously uncontaminated ash storage basin. Needless to say, we are extremely disappointed with your company's apparent disregard for our pollution control requirements.

We have spent considerable public funds to insure that the material discharged by your company is disposed of in an environmentally safe manner.

We wish to discuss this situation with you at a meeting at our central office, 2000 Hampton Avenue. A tentative date and time for this meeting would be December 10, 1981, at

9:00 a.m. Please notify my office of your availability for such a meeting.

Very truly yours,

Charles B. Kaiser, Jr.
Executive Director (Acting)

CBK/kam

cc: Roger Wieting
Bernard A. Rains

METROPOLITAN ST. LOUIS SEWER DISTRICT

October 2, 1980

Mr. Lee Booth
Radiation Management Corp.-Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

clk 10/9/80

Dear Mr. Booth:

We have mailed the five composite samples collected during the week of September 22 through 26 from the Bissell Point Sewage Treatment Plant system and the seventeen samples returned from NUS to the Philadelphia address below which you gave to me by telephone.

University City Science Center
3508 Market Street
P.O. Box 7940
Philadelphia, PA 19101
Attention - Steve Weis

The samples were delivered to United Parcel Service today. The attached list identifies the samples and lists the approximate weight of ash per sample bottle. As we discussed by telephone the Bissell Point simulated ash sample composited from September 22 to 27 is less than 500 grams (266 grams) and the seventeen samples originally analyzed by NUS are considerably less than 500 grams per sample. The location coordinates shown for the fourteen Ash Basin No. 1 samples collected from 12/19/79 through 1/9/80 are grid points from the attached depth grid.

If we may be of any further assistance please give us a call.

Sincerely,

Leo Groseclose

Leo Groseclose
Ind. Waste Lab Supervisor

LG:kat

Enc.

cc: Bernie Rains

SAMPLE SOURCE	LOCATION	SAMPLE DATE	SAMPLE TIME	TYPE SAMPLE	NUS NO.	APPROX. NET WT.
BP Ash Basin #1	SW corner newly deposited	7/31/80	0930	Grab	12039	59g
BP Grit	Containers (2)	7/31/80	0800 to 1600	Comp.	12040	49g
BP Ash Basin #1	A50-0.5	12/20/79	0900	Grab	12041	25g
"	A -0.5	12/20/79	-	"	12042	45g
"	A -1.00	12/21/79	1200	"	12043	37g
"	A -1.00	12/24/79	-	"	12044	23g
"	B -2.00	12/26/79	-	"	12045	39g
"	B -2.00	12/27/79	-	"	12046	29g
"	A50-2.00	12/28/79	-	"	12047	67g
"	B -2.50	12/31/79	-	"	12048	35g
"	B50-1.50	01/02/80	-	"	12049	33g
"	B -3.00	01/03/80	-	"	12050	21g
"	B -5.00	01/04/80	-	"	12051	38g
"	C -1.00	01/07/80	-	"	12052	31g
"	C -2.00	01/08/80	-	"	12053	28g
"	D -2.00	01/09/80	-	"	12054	41g
BP Filter Cake	Simulated Ash	8/15/80 to 8/18/80	0700 to 0700	Comp. from 3-8 hr. Comp.	12157	116g
BP Filter Cake	Simulated Ash	9/22/80 to 9/27/80	0700 to 0700	Comp. from 3-8 hr. Comp.	-	266g
BP Interceptor	Branch St. & Hall Dropshaft	9/22/80 thru 9/26/80	70-80 min daily	Comp. of 5 days	-	750g
Outfall to BP Interceptor	Ft. of Destrehan St. Sewer	"	30-60 min daily	"	-	510g
BP Interceptor	So.Gateway to BP Pump Sta.	"	35-60 min daily	"	-	503g
BP Interceptor	Withers St. & Hall Dropshaft	"	30-60 min daily	"	-	600g

TOTAL AREA USED IN PIT.

61758.68 Cu Yds.

NOTE: DEPTH FOR PIT #1 WAS CAL. FROM DIMENSIONS OF PIT #2.

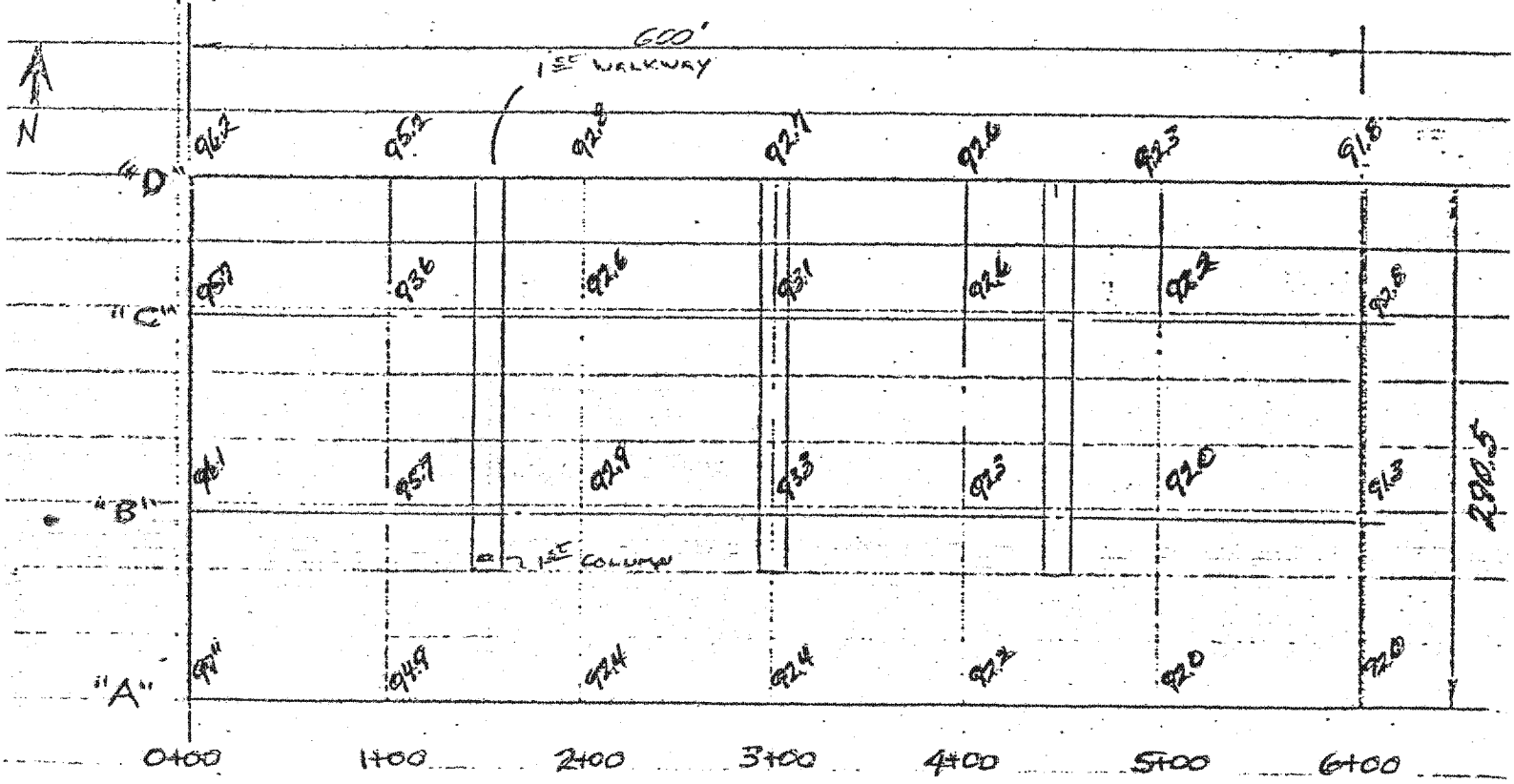
TOP OF PIT ELEVATION = 100.00

95787.05 Cu Yds. TOTAL

- 61758.68 Cu Yds. FILLED

34028.37 cu yds. REMAIN

ASH PIT



Mallinckrodt 10/13/80

Noble Johnson
Bill Eichman
Roger Weeting
George Schillinger
Susie Davis

1. Hall St. prior to 1973 MSD dumped June 1972 (Mallinckrodt started)
meter: Everline PRM-7
only 1½ years
75% @ background (Gamma rad.)
25% background to max
parking lot okay for area
further study needed of basement

2. Angelica pile 1973 – March '77
50' centers (homogeneous) 19.7 airworthy [illegible]
not very much variation
level 8.7 ± 1.9 picocuries/gram
-238 daughters from radium { lead 214 = 7.7 ± 1.9
bismuth 214 = 6.6 ± 1.0
no problem with gamma 137 [200/500
~~B.~~ radon excitation okay if on top of pile
~~E.~~ concrete ⅓ to ½ of ash in cement volume

3. Bissell March 77 – June 80
27 ft centers more hetrogeneous (surface measurements varied by fact. 2)
long + vert.

(3. cont)

radium 226	9.9	± 1.4
Pb 214	7.8	± 0.5
bismuth 214	8.8	± 0.5

gamma if 18 picocuries/gm ∴ 32 microrch/hr (cal.)
cap with 4 ft soil reduce by 0.1
improve homogeneity by mixing (cross cut)
should move wetted down
{radon excitation : layering technique } no sign. problem
{within range for soils
where its going (restructures)

water table disposal ↕ may be ~~benefits~~

concrete block : 5 picoci/gm 20% limit

4. 1ST ash
5. grit
6. filter cake/ashed 7. ...

* Mallinckrodt adding about 15% of present radium
other sources

Mallin. still discharge but try to isolate Radium 226
Uranium } ~~unreacted~~ are being held?
Thorium

62 pieces @ Shelton. Sludge over 100 days will add 1 piece or 15% if 7 @ Bissell + liquid @ 1 piece/gram of Bissell

* Mallinckrodt will analyze samples during controlled discharge review new M. HW amend. for ☆

METROPOLITAN ST. LOUIS SEWER DISTRICT

October 28, 1980

Mr. Noble Robinson, Director
Environmental Affairs
Mallinckrodt, Inc.
675 Brown Road
P. O. Box 5840
St. Louis, Missouri 63134

BJR 11/4/80

Dear Mr. Robinson:

We are in receipt of your letter dated October 24, 1980, outlining a plan for cleaning your west wastewater basin. As we have just received your letter, we have not had adequate time to analyze and study your proposed procedure and method for cleaning this basin. We are also uncertain at this time of the effect that this discharge will have on MSD.

We realize the urgency of your need for approval and will advise you shortly of our decision. However, until you receive our approval, you are not authorized to begin this operation on November 3, 1980.

Sincerely,

Roger Wieting

Roger Wieting, Director
Wastewater Department

RW:lft

cc: Mr. Bernie Rains
Mr. George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

October 31, 1980

Mr. Lee Booth
Radiation Management Corporation
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

Enclosed are copies of three letters, two sent to us by Mallinckrodt, Incorporated and a letter we sent to Mallinckrodt in reply to their letter dated October 24, 1980. Mallinckrodt's October 23, 1980 letter provides information concerning sampling and analysis of ash piles by the NUS Corporation. Please review the information submitted in line with our work agreement.

We have informed Mallinckrodt to delay the discharge of solids from their West wastewater basin. Before we make a decision whether to allow such discharge, we need your recommendation. Conceivably, if the current ash from our Bissell Point incinerator is less than the 5 picocuries limit, we could probably accept their sludge at a predetermined rate and not exceed the limit. If you have data on the current ash samples we submitted to you, it would help us make a decision on this matter.

Please call us at your earliest convenience.

Sincerely,

Bernard A. Rains

Bernard A. Rains, P.E., Manager
Industrial Pollution Control

BAR:kat

Enc.

cc: C. B. Kaiser, Jr.
R. S. Flick
R. Wieting

Calculated Gross Annual Ra226 at Mallinckrodt, 3600 No. 2nd St. (based on Ra226 of 60pci/gram) From Questionaire dated 12/5/77 — 11/4/80

Ref. 001 for 30 inch sewer below retention & neutralizing basins at Wharf & Destrehan Streets. MSD SP#1. Flow = 2,622,000 GPD

Susp. Solids = 377 mg/L average plus additional solids of 710,500 lbs per 6 months flushed to sewer weekly for grit chambers and tri-annually from holding basins. Averaging 710,500 lbs over six months brings susp. solids average to 555 mg/L or a 178 mg/L additional average susp. solids

Ave. Susp. Solids (377 mg/L)

377 × .003785 = 1.426945 grams/gal
× 2,622,000 MGD = 3,741,449.8 grams/day
× 60 picocuries/gram = 2.2449 × 10^8 picocuries/day
× 365 days = 8.1939 × 10^{10} picocuries/yr.
÷ 1 × 10^{12} = 0.081939 curies/yr. ✓

Additional Susp. Solids (178 mg/L — due to flushed solids)

178 × .003785 = 0.67373 grams/gal.
× 2,622,000 MGD = 1,766,520.1 grams/day
× 60 picocuries/gram = 1.0599 × 10^8 picocuries/day
× 365 days = 3.8687 × 10^{10} picocuries/yr.
÷ 1 × 10^{12} = 0.038687 curies/yr.

Total Susp. Solids (555 mg/L, Ave. plus calc. flushed solids)

0.081939 + 0.038687 = 0.120626 curies/yr.

Max. Susp. Solids (65,000 mg/L)

65,000 × .003785 = 246.025 grams/gal

× 2,622,000 mgd = 6.4508×10^8 grams/day

× 60 picocuries/gram = 3.8705×10^{10} picocuries/day

× 365 days = 1.4127×10^{13} picocuries/yr.

÷ 1×10^{12} = 14.127 curies/yr.

Mallinckrodt/MSD 11/6/80
disposal meeting

161,000 #
62 picocuries/gm Radium 226

* send 2 monthly to RM

METROPOLITAN ST. LOUIS SEWER DISTRICT

November 10, 1980

Mr. Lee Booth
Radiation Management Corporation
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

Enclosed is a letter dated November 10, 1980 and attachments from Mallinckrodt, Inc. Information is provided concerning their proposed disposal of the settling basin solids into our sewer system. Please review this information and give us your recommendation on acceptance and rate of discharge of this material to our treatment system. I realize we should have more background information on the Radium 226 content of our ash. By separate mailing we are sending monthly composites of our ash for Radium 226 analysis. The composites are made up for the months of August, September and October, 1980. Please expedite the analysis of these samples to enable establishment of Bissell Point background Radium 226. Such background values will enable us to determine what volume of solids can be discharged by Mallinckrodt without exceeding the 5 picocurie/gram limit.

We are also submitting by separate mailing a one gallon sample of the leachate delivered by truck to our Bissell Point facility from the Westlake Landfill. Because of the radioactive waste stored at the Westlake Landfill, it was considered the leachate could be another source of Radium 226 in our Bissell Point ash. We want to verify or discredit this possibility.

If you have any question, please call me.

Sincerely,

Bernard A. Rains

Bernard A. Rains, P.E., Manager
Industrial Pollution Control

BAR:kat

Enc.

cc: C. B. Kaiser, Jr.
R. S. Flick
R. Wieting

the Trash Men inc.

commercial
and industrial
waste disposal
service

4532 Audubon Avenue
Saint Louis, Missouri 63110

535-1020

WEST LAKE - DATES AND QUANITY

10/31/79	3	12/4/79	3	1/9/80	1
11/1/79	6	12/5/79	4	1/10/80	2
11/2/79	6	12/6/79	3	1/11/80	3
11/3/79	7	12/7/79	3	1/12/80	3
11/5/79	8	12/8/79	4	1/14/80	3
11/6/79	6	12/10/79	4	1/15/80	2
11/7/79	7	12/11/79	6	1/16/80	3
11/8/79	6	12/12/79	4	1/17/80	3
11/9/79	5	12/13/79	5	1/18/80	3
11/10/79	6	12/14/79	5	1/19/80	3
11/12/79	2	12/15/79	4	1/21/80	3
11/13/79	4	12/17/79	4	1/22/80	2
11/14/79	4	12/18/79	5	1/23/80	1
11/15/79	2	12/19/79	6		
11/16/79	3	12/20/79	3	FEBRUARY, 1980 NO LOADS	
11/17/79	6	12/21/79	3		
11/23/79	5	12/22/79	3	3/24/80	1
11/24/79	6	12/26/79	3	3/28/80	1
11/27/79	2				

the Trash Men inc.

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4532 Audubon Avenue
Saint Louis, Missouri 63110

535-1020

WEST LAKE - DATES & QUANITY

4/3/80	1	5/1/80	2	5/27/80	6
4/7/80	1	5/2/80	7	5/28/80	7
4/11/80	1	5/3/80	6	5/29/80	6
4/21/80	2	5/5/80	7	5/30/80	3
4/22/80	6	5/6/80	5	5/31/80	6
4/23/80	7	5/7/80	8		
4/24/80	4	5/8/80	7	6/2/80	7
4/25/80	5	5/9/80	7	6/3/80	6
4/26/80	3	5/10/80	6	6/4/80	6
4/28/80	7	5/12/80	8	6/5/80	5
4/29/80	6	5/13/80	7	6/6/80	7
4/30/80	7	5/14/80	8	6/7/80	5
		5/15/80	6	6/9/80	8
		5/16/80	4	6/10/80	8
		5/17/80	2	6/11/80	7
		5/18/80	1	6/12/80	7
		5/19/80	7	6/13/80	7
		5/20/80	4	6/14/80	6
		5/21/80	7	6/16/80	8
		5/22/80	6	6/17/80	7
		5/23/80	8	6/18/80	6
		5/24/80	6	6/19/80	5

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535-1020

WEST LAKE - DATES & QUANITY

6/20/80	8	7/19/80	4	8/14/80	6
6/21/80	4	7/21/80	6	8/15/80	8
6/23/80	7	7/22/80	5	8/16/80	6
6/24/80	8	7/23/80	6	8/18/80	7
6/25/80	6	7/24/80	5	8/19/80	6
6/26/80	7	7/25/80	6	8/20/80	7
6/27/80	8	7/26/80	3	8/21/80	7
6/28/80	6	7/28/80	4	8/22/80	4
6/30/80	7	7/29/80	6	8/23/80	4
		7/30/80	5	8/25/80	4
7/2/80	2	7/31/80	7	8/26/80	7
7/3/80	6			8/27/80	8
7/7/80	8	8/1/80	8	8/28/80	7
7/8/80	7	8/2/80	6	8/29/80	6
7/9/80	4	8/4/80	7	8/30/80	5
7/10/80	6	8/5/80	5		
7/11/80	7	8/6/80	8	9/2/80	8
7/12/80	6	8/7/80	7	9/3/80	7
7/14/80	6	8/8/80	5	9/4/80	7
7/15/80	6	8/9/80	6	9/5/80	2
7/16/80	9	8/11/80	7	9/6/80	5
7/17/80	7	8/12/80	7	9/8/80	8
7/18/80	4	8/13/80	7	9/9/80	7

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535-1020

WEST LAKE- DATES & QUANITY

9/10/80	7	10/6/80	7	11/1/80	2
9/11/80	4	10/7/80	7	11/3/80	8
9/12/80	3	10/8/80	3	11/4/80	5
9/13/80	5	10/9/80	2	11/5/80	7
9/15/80	8	10/10/80	5	11/6/80	6
9/16/80	6	10/11/80	5	11/7/80	10
9/17/80	8	10/13/80	6	11/8/80	6
9/18/80	7	10/14/80	7		
9/19/80	8	10/15/80	6		
9/22/80	7	10/16/80	7		
9/23/80	6	10/18/80	6		
9/24/80	5	10/20/80	4		
9/25/80	3	10/21/80	4		
9/26/80	9	10/22/80	6		
9/27/80	6	10/23/80	6		
9/29/80	6	10/24/80	5		
9/30/80	7	10/25/80	4		
		10/27/80	4		
10/1/80	7	10/28/80	4		
10/2/80	7	10/29/80	3		
10/3/80	6	10/30/80	4		
10/4/80	6	10/31/80	6		

METROPOLITAN ST. LOUIS SEWER DISTRICT

November 20,1980

Mr. Lee Booth
Radiation Managment Corporation
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

Enclosed is a copy of a letter from Mr. William A. Erdman who is an attorney for Mallinckrodt, Inc. Mallinckrodt representatives have stated several times that they do not believe, under existing regulations, that we have a hazardous waste based on Radium 226 content. I asked Mr. Erdman if he would give us his legal opinion concerning the Radium 226 content of our Bissell Point incinerator ash. Enclosed is a copy of a letter documenting his interpretation.

Please review the information contained in his letter as possible support for your recommendation relative to ultimate disposal or use of our stored ash.

If you have formulated your recommendation relative to our acceptance of Mallinckrodt's basin sludge and rate of discharge, please contact us as soon as convenient.

Sincerely,

Bernard A. Rains

Bernard A. Rains, P.E., Manager
Industrial Pollution Control

BAR:kat

Enc.

cc: C. Kaiser
R. Flick
R. Wieting

10 EAST GRAND AVENUE • ST. LOUIS, MISSOURI 63147 • CENTRAL 1-1950

METROPOLITAN ST. LOUIS SEWER DISTRICT

November 10,1980

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue 60062
Northbrook, Illinois

Dear Mr. Booth:

We have mailed five (5) additional ash samples to Mr. Steve Weis in Philadelphia for rush analysis by "GC5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

The source of the two samples and their approximate weights are as follows:

Source	Location	Date - Sample Time	Type	Approx. Net Wt.
Bissell Pt. STP	"Simulated" Ash +	(08/01/80 to 08/31/80)	Comp.	75 g.
Bissell Pt. STP	"Simulated" Ash +	(09/01/80 to 09/30/80)	Comp.	483 g.
Bissell Pt. STP	"Simulated" Ash +	(10/01/80 to 10/31/80)		480 g.
Lemay STP	West Lagoon Ash	08/19/80 0900	Grab *	608 g.
Alpha Portland Cement Co.	Bottom Ash	11/04/80 -	-	1070 g.

+ Filter Cake ignited in muffle Furnace
* Aliquot from 2-inch core 5-foot deep in center of lagoon

If there are any questions or we may be of further assistance, please contact or call us.

Sincerely,

Leo Groseclose

Leo Groseclose
Ind. Waste Lab Supervisor

LG:kat

cc: Bernie Rains

11/12/80

METROPOLITAN ST. LOUIS SEWER DISTRICT

November 13, 1980

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed a one-gallon liquid sample to Mr. Steve Weis in Philadelphia for Procedure RØ3, "Analysis of Water Sample for Ra 226 by Randon Emanation." The sample was delivered to United Parcel Service today.

The source and background on the sample is:

Source	Location	Date-Time	Volume
Westlake Landfill Leachate	B.P. STP by Trashmen	11/12/80 @ 1120	1 gallon sample from 5,000 gal. tank

If there are any questions or we may be of further assistance, please call us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab. Supervisor

LG:kat

cc: Bernie Rains

BR 11/13/80

METROPOLITAN ST. LOUIS SEWER DISTRICT

November 24, 1980

Mr. Lee Booth
Radiation Management Corporation
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Lee:

As discussed with you on the telephone this morning, I am forwarding the computer printouts sent to me from your Philidelphia laboratory. Please note that they were sent to our 2000 Hampton Avenue address. Please make certain all future reports and correspondence are sent to my attention at our 10 East Grand Avenue address.

Thank you for your attention to this request.

Sincerely,

Bernard A. Rains

Bernard A. Rains, P.E., Manager
Industrial Pollution Control

BAR:kat

Enc.

METROPOLITAN ST. LOUIS SEWER DISTRICT

December 2, 1980

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed a three-liter liquid-sludge sample to Steve Weis in Philadelphia for Procedure RØ3, "Analysis of Water Sample for Ra 226 by Radon Emanation." The sample was delivered to United Parcel Service today.

The source and background on the sample is:

Source	Location	Date - Time	Volume
Mallinckrodt Chemical Works	East Basin Sludge	12/1/80 @ 0930	3-Liter (±) of semi-liquid sludge

If there are any questions or we may be of further assistance, please call us.

Sincerely,

Leo Groseclose

Leo Groseclose
Ind. Wast Lab. Supervisor
(314) 231-1950

LG:kat

cc: Bernie Rains ✓ GSR 12/15/80

Mallinckrodt

MEMO TO: Roger Wieting

FROM: Bernie Rains

SUBJECT: Mallinckrodt Discharge

DATE: January 28, 1981

Your memo of January 27, 1981 has been forwarded to Leo Groseclose to obtain the requested information. We have collected samples of their settling basin solids which have been sent to Radiation Management Corporation for analysis. Mallinckrodt is required to and has been notifying us each time they flush their east basin. At that time additional samples can be collected of their flushings. The Bissell Point plant personnel should be alerted to collect ash samples during the period of flushing. Since Si Smith has worked for Mallinckrodt, I will ask him to set up a tour for you at a convenient time to both you and Mallinckrodt Plant personnel. He may be of value in pointing out production areas and process activities.

If you have any question, please call me.

BAR:kat

cc: R. S. Flick
C. B. Kaiser
G. Schillinger
L. Groseclose
S. Smith

Mallinckrodt Meeting 1/27/81

1. ash pile disposition
2. reimbursement of MSD $ ☆ (extraordinary costs) will pay?
3. receipt of Mall. Wast Basin + waste now being recd. (59 pieces/yr)
4. letter to Mo. Div. of Health

Those present:

MSD: CBK, RSF, CRW, GRS, BAR

Mall. Ray Asher, Bill Erdman, Bobbie Robinson

* ① take another sample from dock & trench - etc
② take core sample from Hall St. area (2)

we can obtain a sample. He tentatively thought they had analyses for the Thanksgiving flush but not for the Christmas flushing.

If I haven't heard from him by Monday, February 2, 1981, I'll call him back.

cc: ~~Wiang~~
~~Flick~~
~~Waiser~~

METROPOLITAN ST. LOUIS SEWER DISTRICT
INDUSTRIAL WASTE DIVISION
ROUTE SLIP

	Recipient	Init.	Date
1	MANAGER	[illegible]	3/12/81
	ASST. MANAGER		
	LAB SUPERVISOR		
	ENGINEER(Field)		
	ENGINEER(Admin.)		
	SECRETARY		
	TYPIST CLERK II		
	FILE:		

ACTION:

Memo to: Bernie Rains
From: Lee Groseclose
Date: Feb. 17, 1981
Subject: Mallinckrodt Tour

Today at 10:00 Pm Roger Wieting, George Schillinger and I met with Mallinckrodt management personnel to discuss and tour their Columbium-Tantalum Process. Those present representing Mallinckrodt were:

Noble Robinson - Director of Environmental Affairs
Ed Monaco - St. Louis Site Services Supervisor
Craig Fohler - Senior Environmental Engineer
Roger Johnsen - Utility Supervisor
Ed Lutwiler - Superintendent C-T plus Processes
Tom Berg - Analytical Chemist (Title I)

Mr. Robinson chaired the meeting. He made introductions and then reviewed the questions asked by MSD. Ed Lutwiler then presented and reviewed first a Process Flow Summary for C-T Process (attached) and next a URO System Flow Diagram (attached). Ed stated the C-T Process was operated approx. 6 days a week on 24 hours a day basis. The "Acid Addition" is hydrofluoric acid. The definition of URO was indicated to be "unreacted ore" or the acid insoluble portion of the process. The final flow to the B.P STP was stated to be 2.7 MGD. Ed stated the URO system as shown in the flow diagram had been installed in early Nov., 1980.

Apparently the two 1000-gallon neutralizer tanks and dryer had been installed then because they previously had drummed the neutralized, dewatered slurry. They stated the dried URO might possibly be concentrated enough to be a radioactivity raw material source.

Mr. Noble Robinson then put the following table on the blackboard. The data represented concentrations from analyses performed by the NUS Corp.

Levels IN Total (7 day basis) (pico Curies)		URO Dry	URO Wash	Raffinate Portion	Columbium Salt Mother Liquor	Tantalum Salt Mother Liquor
U	2.32×10^9	79%	20%	2%	0.5%	0.1%
Th	458×10^8	92%	0.7%	0.1%	0.03%	0.008%
Ra_{226}	1.69×10^9	81%	~4% (test limit)	<0.3%	<0.6%	<0.9%

Mr. Robinson stated that Tom Berg was setting up an H-P Scintillometer for continuous monitoring of the radiation. He stated that they have an engineering study underway to plan for continuous sampling of the C-T Process. He discussed the settling ponds and their cleaning. He stated that the material involved averages approx. 5 microns after the ball mill and would be further reduced in size by the acid. He discussed the precipitation of the material in their settling basins, their evaluating means to keep it in suspension and their approx. four-month flushing of those basins.

The clean-up and flushings of the basins on Dec.

1 and 2, 1980 involved an estimated 184,000 pounds of solids. They had last been cleared in July, 1980. Two buckets of the December solids were composited and analysis showed a 2.4 μCi/g radioactivity. This compared to 60 μCi/g radioactivity as analyzed by NUS on the July flush solids. Calculating the 2.4 μCi/g to the 2.7 MGD flow yielded a 0.1 μCi/ml. concentration in the Mallinckrodt sewer compared to a 900 μCi/ml. NRC regulation. In another settling basin flush on Jan. 2, 1981 an estimated 16,000 pounds of solids were involved. No samples were obtained but the activity estimated from the table data (probably high) was 300 μCi/ml. which calculated to flow was 2.7 μCi/ml.

Mr. Wieting asked if there was any other radioactive sources from Mallinckrodt processes besides the C-T Process. Mr. Robinson stated the only other radioactive source was the Potassium Process which was rather insignificant.

Mr Lutwiler and the others except for Mr. Robinson then took us on a tour of the physical facilities for the URO System which are in Plant 5, Bldg. 238. Mr Jim Harlin, the process supervisor, and Bruce Lee guided the tour. Then Ed Monaco and Roger Johnsen guided us on a tour of the Mallinckrodt Waste

Treatment facilities. The west basin was drained and uncleaned. We observed the automated pH control system. George Schillinger noted a bypass drain at the north-east corner of the basins that was flowing "considerable waste". He thought it should be closed and affixed with an MSD seal.

The tour was over at 11:30 Am and we return to the Bissell Pt. STP.

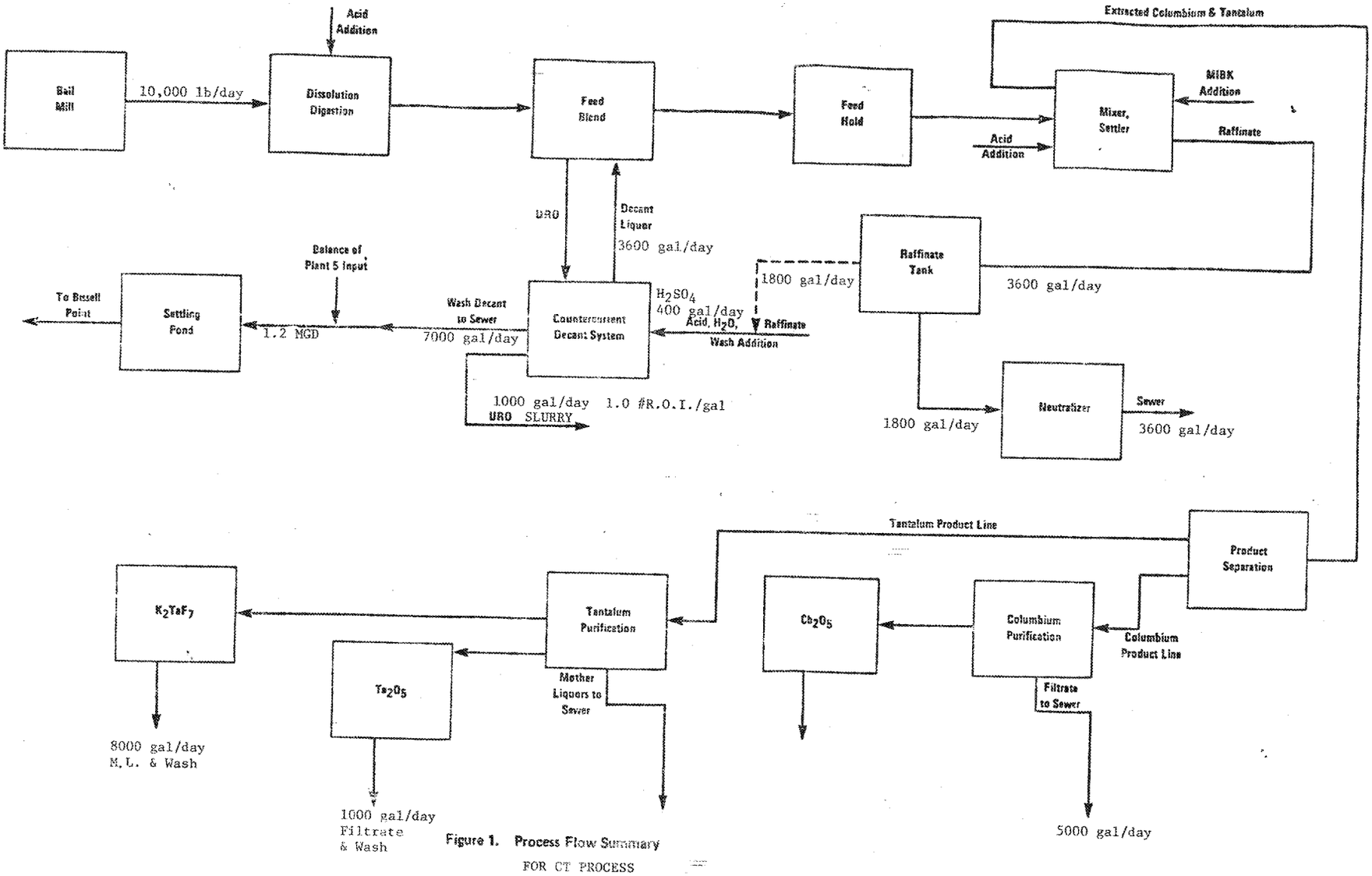
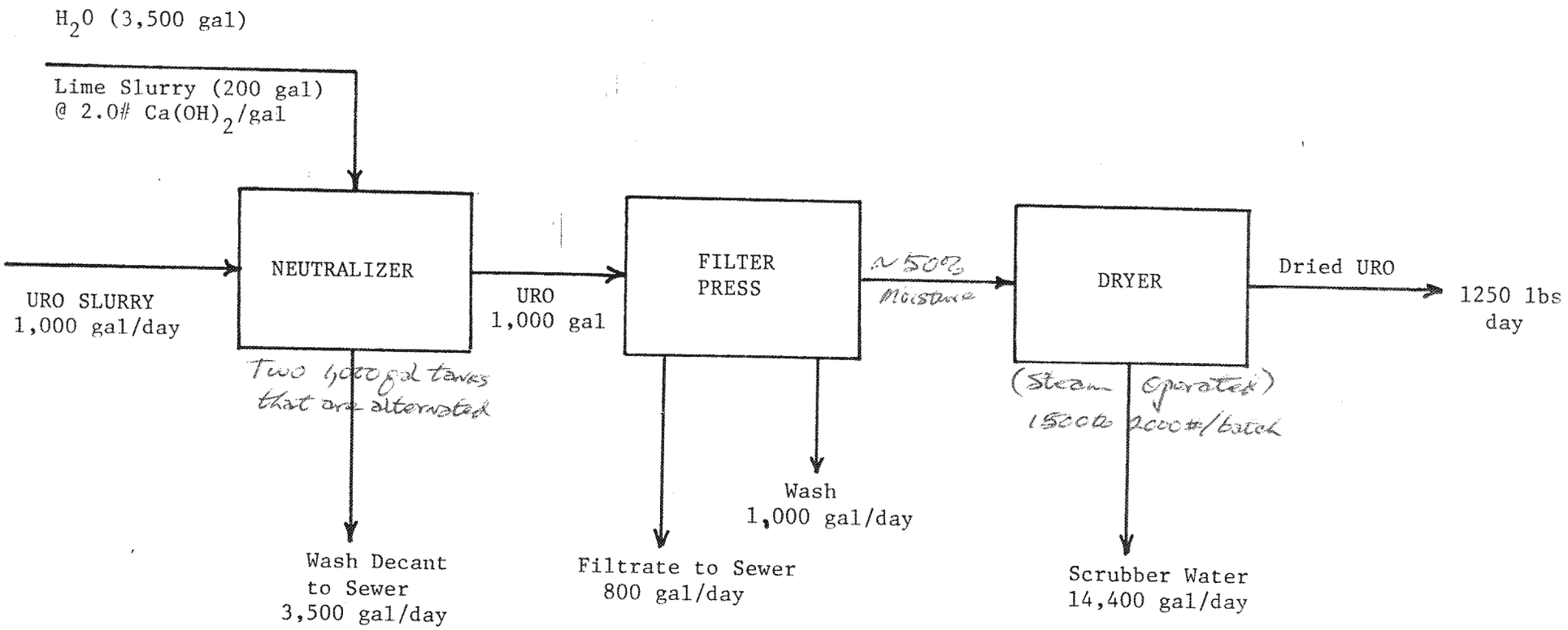


Figure 1. Process Flow Summary

FOR CT PROCESS

URO SYSTEM FLOW DIAGRAM Installed early Nov., 1980



METROPOLITAN ST. LOUIS SEWER DISTRICT

March 11, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed four (4) additional ash samples to Mr. Steve Weis in Philadelphia for analysis by "GC5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

These samples are the first in the series of Bissell Point simulated ash composites that are to be analyzed on a monthly basis for Radium 226 levels. The four composites which are being transmitted are for the months of November, December, January and February, 1981. Each of the composites are 500 grams and were prepared by lab-firing filter cake at 650°C.

If there are any questions, please contact or call us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: Bernie Rains

METROPOLITAN ST. LOUIS SEWER DISTRICT

May 15, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed two (2) additional ash samples to Mr. Steve Weis in Philadelphia for analysis by "GC5 GE (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

The source of the two samples and their approximate weights are as follows:

Source	Location	Date	Time	Sample Type	Net Wt.
Hall Street Landfill	Point A	5/8/81	1145	Grab*	580 g.
Hall Street Landfill	Point B	5/8/81	1215	Grab*	527 g.

* 6 inches deep

If there are any questions, please contact or call us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: Bernie Rains

Radiation Management Corporation

LABORATORY REPORT

3608 Market Street
Philadelphia, Pa. 19104
(215) 243-2950

Date of Report:
5/27/81

METROPOLITAN ST. LOUIS SEWER DISTRICT
10 E. GRAND AVE.
ST. LOUIS, MO. 63147
ATTN: MR. BERNARD RAINS

BR 6/5/81

PURCHASE ORDER #:

CUSTOMER SAMPLE ID : SEW-SLD-PT. A
SAMPLE DESCRIPTION : MISCELLANEOUS SOLID
DATE STARTED SAMPLING: 5-8-81 1145 EST
DATE STOPPED SAMPLING: 5-8-81 1145 EST
DATE OF ANALYSIS : 5-26-81 1201 EST
RMC SAMPLE ID. : 56021685
PROCEDURE DESCRIPTION:
GELI GAMMA SPECTROSCOPY OF DRIED SOLID SAMPLES

REPORT UNITS : PICOCURIES/GRAM DRY
ALIQUOT SIZE : 128.30 GRAMS

ISOTOPE	ACTIVITY	ERROR	%ERROR	LLD	ISOTOPE	
PA-234	********	********	********	4.7E-01	PA-234	***
PB-214	********	********	********	3.2E-01	PB-214	***
BI-214	7.5E-01	1.5E-01	19	********	BI-214	***
AC-228	********	********	********	4.4E-01	AC-228	***
PB-212	********	********	********	2.2E-00	PB-212	***
BI-212	********	********	********	1.4E-00	BI-212	***
TL-208	********	********	********	1.4E-01	TL-208	***
U-235	********	********	********	5.8E-01	U-235	***
TH-227	********	********	********	8.7E-01	TH-227	***
K-40	8.7E-00	1.4E-00	16	********	K-40	
BE-7	********	********	********	6.8E-01	BE-7	
SB-125	********	********	********	2.1E-01	SB-125	
CS-137	********	********	********	9.5E-02	CS-137	
CO-60	********	********	********	7.6E-02	CO-60	
ZR-95	********	********	********	1.9E-01	ZR-95	
NB-95	********	********	********	1.4E-01	NB-95	
RA-226	7.5E-01	1.5E-01	19	********	RA-226	
PA-234M	********	********	********	1.7E-01	PA-234M	***
TH-234	********	********	********	1.4E-01	TH-234	***
PA-231	********	********	********	1.3E-01	PA-231	***
TH-230	********	********	********	3.1E-02	TH-230	***
TH-228	********	********	********	4.8E-01	TH-228	***

*** = ISOTOPE NOT DECAY-CORRECTED

COMMENT : ASH; HALL ST. LANDFILL

Signature: Dan Na

MSD 000789

Radiation Management Corporation

LABORATORY REPORT

3508 Market Street
Philadelphia, Pa. 19104
(215) 243-2950

Date of Report:
5/27/81

METROPOLITAN ST. LOUIS SEWER DISTRICT
10 E. GRAND AVE.
ST. LOUIS, MO. 63147
ATTN: MR. BERNARD RAINS

PURCHASE ORDER #:

CUSTOMER SAMPLE ID : SE-SLD-PT. A
SAMPLE DESCRIPTION : MISCELLANEOUS SOLIDS
DATE STARTED SAMPLING: 5-8-81 1145 EST
DATE STOPPED SAMPLING: 5-8-81 1145 EST
DATE OF ANALYSIS : 5-26-81 1201 EST
RMC SAMPLE ID. : 56021685
PROCEDURE DESCRIPTION:
GELI GAMMA SPECTROSCOPY OF DRIED SOLID SAMPLES

REPORT UNITS : PICOCURIES/GRAM DRY

ALIQUOT SIZE : 128.30 GRAMS

ISOTOPE	ACTIVITY	ERROR	%ERROR	LLD	ISOTOPE	
PA =234	********	********	********	4.7E-01	PA =234	***
PB =214	********	********	********	3.2E-01	PB =214	***
BI =214	7.5E-01	1.5E-01	19	********	BI =214	***
AC =228	********	********	********	4.3E-01	AC =228	***
PB =212	********	********	********	2.2E 00	PB =212	***
BI =212	********	********	********	1.4E 00	BI =212	***
TL =208	********	********	********	1.4E-01	TL =208	***
U =235	********	********	********	5.8E-01	U =235	***
TH =227	********	********	********	8.7E-01	TH =227	***
K = 40	8.7E 00	1.4E 00	16	********	K = 40	
BE = 7	********	********	********	8.8E-01	BE = 7	
SB =125	********	********	********	2.1E-01	SB =125	
CS =137	********	********	********	9.5E-02	CS =137	
CO = 60	********	********	********	7.6E-02	CO = 60	
ZR = 95	********	********	********	1.9E-01	ZR = 95	
NB = 95	********	********	********	1.4E-01	NB = 95	
RA =226	7.5E-01	1.5E-01	19	********	RA =226	
PA =234M	********	********	********	1.7E 01	PA =234M	***
TH =234	********	********	********	1.4E 01	TH =234	***
PA =231	********	********	********	1.3E 01	PA =231	***
TH =230	********	********	********	1.1E 02	TH =230	***
TH =228	********	********	********	4.8E-01	TH =228	***

*** = ISOTOPE NOT DECAY-CORRECTED

COMMENT : ASH/HALL ST. LANDFILL

Signature: Don Van

MSD 000790

Mallinckrodt 6/5/81

low radio. material (4 month process, synthetic)
most good discharge

11 to get def. of dis. relative dispersibility

Mallinckrodt 6/22/81

Bill Erdman
Ed Monaco
George Schillinger
RHR

1. John Hickey — NRC phone (mat. lic. branch)
2. outside consul to reg. off. (2)
3. no objective test (case by case basis
   * at point of entry into sewer
4. public documents reviewed:
   no cases

(normal flow; if settles, not dispersible)

Q: POTW system
1960

* any way other than formal letter to MSD from NRC ?!

METROPOLITAN ST. LOUIS SEWER DISTRICT

June 22, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period of June 7 through June 11, 1981. The simulated ash composite sample weighs 260 grams and was prepared by lab-firing filter cake at 650°C.

If there are any questions, please contact us.

Sincerely,

Leo Grosclose

Leo Grosclose
Industrial Waste Lab Supervisor

LG:nk

cc: B.A. Rains

6/29/81

1. liability assumption ? other contributions
2. past — future $
3. 2 consultants get together
4. don't risk public exposure e.g. state + NRC

July 9, 1981

meeting with Kaiser re: ✡ + GLC

1. re: Mall.
   letter from:
   a. are in compliance with NRC
   b. monitor to assure < 5
   c. additional reasonable fee for acceptance
   d. future liability for pond material

2. RMC
   set up meeting

3. disposal alternatives: Board of Trustee notification
   a. Alpha Portland as is (Bissell)
   b. " " with Lemay/Bissell Island
   c. landfill (Bissell) demolition
   d. store on MSD property
   e. discharge to Miss. R. per NPDES - SS level
   f. have Superfund evaluate + handle
   g. do nothing

7/21/81

1. make NRC inspector make decision as to compliance

if you'll take our ask we consider . . . (Taking less than 5) - - -

A. don't take west pond until all 9 is gone (Mallinckrodt help pay for) alpha free

daily cover @ Westlake Quarry (dump charge)

METROPOLITAN ST. LOUIS SEWER DISTRICT

July 22, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed two additional ash samples to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

The samples are Bissell Point simulated ash composites for the periods of July 1 through July 10, 1981 and July 11 through July 17, 1981. The simulated ash composite samples weigh about 120 grams each and they were prepared by lab-firing filter cake at 650°C.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains

METROPOLITAN ST. LOUIS SEWER DISTRICT

July 31, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period of July 18 through July 24, 1981. The simulated ash composite sample weighs about 120 grams and was prepared by lab-firing filter cake at 580°C.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:pb

cc: B. A. Rains ✓ 8/10/81

METROPOLITAN ST. LOUIS SEWER DISTRICT

August 7, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed two additional ash samples to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The samples were delivered to United Parcel Service today.

The samples are Bissell Point STP simulated ash composites for the periods indicated. It might be helpful in maintaining sample identification if our MSD Lab No. was used in reporting results.

MSD LAB. NO.	Composite Period	Approx. wt.
615	July 1 through 31, 1981	120 grams
615	July 25 through 31, 1981	105 grams

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains ✓ 8/12/81

METROPOLITAN ST. LOUIS SEWER DISTRICT

September 9, 1981

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have mailed an additional ash sample to Mr. Steve Weis in Philadelphia for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solid Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period August 1 through August 31, 1981. The simulated ash composite sample weighs about 206 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No.1108 is used in reporting results.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains ✓ BAR 9/4/81
George Schillinger

October 14, 1986

TO: Roger Wieting

FR: Bernie Rains BR

RE: ULTIMATE DISPOSAL OF BISSELL POINT STP INCINCERATOR ASH STORED NEAR ANGELICA STREET

Composite samples of the Angelica Street ash pile were sent to the TMA Eberline Thermo Analytical Incorporated of Albuquergue, New Mexico for radium-226 analysis. It was considered that six composite samples would be representative of the material in the ash pile since each composite was made up of sub-samples at various elevations and locations within and around the perimeter of the pile. The reason the samples were collected and a radium-226 analysis requested was because of the potential for radium-226 contamination of the ash by Mallinckrodt Chemical Company's processing of uranium and thorium ores. Any radium-226 concentrations above allowable limits would have caused concern for the handling, transport, use, or ultimate disposal of the ash.

In the **June 18, 1986 Federal Register** a notice of proposed rule making was published concerning radiation protection criteria for clean-up of land and facilities contaminated with residual radioactive materials. As of this writing, the proposed criteria for such specific activities have not been published. However, in the Federal Registers of January 5, 1983, October 7, 1983, and September 24, 1986, control criteria was published for uranium and thorium mill tailings at licensed commercial processing sites and uranium mills. The levels of concern for radium-226 are 5 picocuries per gram averaged over the first 15 centimeters of material below the material surface and 15 picocuries per gram if the material is covered at least 15 centimeters with soil. The samples of ash from the Angelica Street pile (see attached analyses) ranged in concentration from 0.6 picocuries per gram to 2.2 picocuries per gram of radium-226 as determined by the Eberline laboratory. These ash concentrations of radium-226 are well below the level of concern (5 picocuries per gram) for an uncovered radioactive material.

Based on current regulations and EPA guidance, the ash from the Angelica Street storage area can be ultimately disposed of without environmental concern in our Prospect Hill Reclamation Project or utilized as an additive in cement manufacturing as is currently being done with our Lemay incinerator ash.

As a safety precaution, we recommend that personnel working with the incinerator ash use a breathing filter-mask to prevent inhalation of any of the ash dust particles. Care should also be taken during transport to ensure that ash particles are not dispersed into the environment from to wind action during travel.

Should you have any comment or question concerning our recommendation, please let us know at your earliest convenience.

kt

att.

pc John Koeper
Al Callier

ALBUQUERQUE LABORATORY

CUSTOMER: Metropolitan St. Louis Sewer Dist.
ATTENTION: Bissell Point STP
ADDRESS: Al Callier
CITY: 10 E. Grand Ave.
W.O. NO.: St. Louis, Missouri 63147
E-6162

REPORT OF ANALYSIS

Radium in incinerator Ash
TYPE OF ANALYSIS

P9754W
CUSTOMER ORDER NUMBER

SAMPLES RECEIVED 7/24/86

Customer Identification	Date Collected	Type of Analysis	Total Wt. (g) dry	pCi/g (dry)
#1BPSTP Ash Pile Angelica St. Ferry St.	7/9/86	Ra-226	647	1.2±0.2
#2BPSTP Ash Pile Angelica- Ferry St.	"	"	599	1.2±0.2
#3BPSTP Ash Pile Angelica- Ferry St.	"	"	648	0.6±0.2
#4BPSTP Ash Pile Angelica- Ferry St.	"	"	660	2.2±0.2
#5BPSTP Ash Pile Angelica- Ferry St.	"	"	659	0.5±0.2
#6BPSTP Ash Pile Angelica- Ferry St.	"	"	687	1.1±0.2

Radium 1.1 pCi/g

cc: Bernard A. Rains

☐ REPORTED VIA TELEPHONE

TMA Eberline
Thermo Analytical Inc.
7021 PAN AMERICAN FREEWAY, N.E.
ALBUQUERQUE, NEW MEXICO 87109
PHONE (505) 345-3461

APPROVED BY Rod Melgard, Mgr. 9/15/86 DATE

MEMO TO: Bernie Rains

FROM: John Lodderhose J.L.

SUBJECT: **Disposal of Incinerated Sludge Ash**

DATE: June 24, 1986

Disposal of incinerated sludge ash in the MSD landfill should be acceptable if the concentration of radium-226 and radium-228 are less than 15 picocuries per gram.

There are two EPA - Federal Registers which have established standards for the control and cleanup of radioactive residual from uranium processing sites. **Title 40 CFR, Part 192** dated **January 5, 1983**, pages **590 - 606** discusses "Standards for Remedial Actions at Inactive Uranium Processing Sites." Subpart A sets standards for the control of residual radioactive materials from inactive uranium processing sites. This regulation states that the site should be controlled for at least 200 years and that radium 222 releases to the air should not exceed 20 picocuries/m^2-second or increase the annual average air concentration by one-half ($\frac{1}{2}$) a picocurie per liter. This federal register contains a table which shows a significant decrease in surface radiation when the radioactive material is covered with soil as shown below:

ESTIMATED COVER THICKNESS (METERS) TO ACHIEVE 20 pCi/M^1S

Radon emission from tailings pCl/m^1s	Percent moisture content of cover			
	6	8	10	12
100	1.7	1.3	1.0	0.7
500	3.4	2.6	2.0	1.5
1,000	4.1	3.2	2.4	1.8 8

Subpart B sets standards for the cleanup of land and buildings contaminated with residual radioactive materials from inactive uranium processing sites. This regulation states that:

"Remedial actions shall be conducted so as to provide reasonable assurance that as a result of residual radioactive materials from any designated processing site:

(a) The concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than--

(1) 5 pCi/g. averaged over the first 15 cm of soil below the surface, and

(2) 15 Ci/g. averaged over 15 cm thick layers of soil more than 15 cm below the surface.

It also deals with any occupied or habitable building, which does not apply in our circumstances.

Title 40 CFR, Part 192 dated October 7, 1983, pages 45926 - 45947 discusses "Environmental Standards for Uranium and Thorium Mill Tailing at Licensed Commercial Processing Sites." Subpart D sets standards for management of uranium byproducts materials pursuant to Section 84 of the Atomic Energy Act of 1954. This section deals with closure performance standards, however these standards do not apply if:

"a concentration of radium-226 in land, averaged over areas of 100 square meters, which, as a result of uranium byproduct material, does not exceed the background level by more than:

(i) 5 picocuries per gram (pCi/g), averaged over the first 15 centimeters (cm) below the surface, and

(ii) 15 pCi/g, averaged over 15 cm thick layers more than 15 cm below the surface.

Subpart E sets standards for management of thorium byproduct materials pursuant to Section 84 of the Atomic Energy Act of 1954. This section includes all of the provisions covered in Subpart D and states that provisions applicable to radium-226 shall also apply to radium-228.

Therefore, it appears that as long as the radium-226 and radium-228 concentrations in radioactive residual are less than 5 picocuries per gram at the surface and less than 15 pecocuries at 15cm below the surface and the surface radium-222 releases are less than 20p Cu/m^2/Second there should be no problems associated with health or environmental protection. Since the sludge ash will be buried under several meters of fill material, the surface releases of radium will be minimized. Therefore, there should be no problems with disposal of sludge ash in the MSD landfill as long as the concentrations of radium-226 and radium-228 are less than 15 picocuries per gram.

I recommend that the sludge ash be analyzed for surface radon radium-222 releases, and for concentrations of radium-226 and radium-228 prior to disposal in the MSD landfill. The leachate and land surface at the landfill should be periodically monitored for radioactivity. I also recommend that personnel working with the contaminated sludge ash use a breathing filter mask since air transmission of radioactive particles is possible.

I have enclosed a copy of the two aforementioned regulations. When you have had a chance to review these, let's discuss the final plans for disposal.

JRL:kat
Enc.

Mallinckrodt, Inc.

675 McDONNELL BLVD. • P.O. BOX 5840 • ST. LOUIS, MO. 63134 • (314) 895-2000

March 25, 1982

Mr. Charles B. Kaiser, Jr.
Acting Executive Director
Metropolitan St. Louis Sewer District
200 Hampton Avenue
St. Louis, Missouri 63139

BKK 4/6/82

Dear Mr. Kaiser:

On several occasions during the past few months representatives of Mallinckrodt, Inc. (Mallinckrodt) and the Metropolitan St. Louis Sewer District (MSD) have held discussions regarding a proposed surcharge billing to be submitted to Mallinckrodt for consultant's fees, staff-related expenses and other expenses related to the disposal of incinerator ash by MSD. As you know, Mallinckrodt has not accepted liability for those fees and expenses.

Nevertheless, rather than litigate or arbitrate this dispute Mallinckrodt agrees to pay MSD $61,916.00. In return MSD agrees that this payment shall not serve as a precedent for any future requests for payment of this nature to Mallinckrodt. Furthermore, MSD agrees that this payment does not represent an admission of liability on Mallinckrodt's part for the work that MSD had performed and for which it billed Mallinckrodt.

Should this letter accurately reflect the resolution of this matter as you understand it, please indicate your agreement by signing and returning this letter.

MALLINCKRODT, INC.

By Mack G Nichols
Mack G. Nichols
Vice President

AGREED:

METROPOLITAN ST. LOUIS
SEWER DISTRICT

By _____
Charles B. Kaiser, Jr.
Acting Executive Director

Mallinckrodt
LEGAL DIVISION

soil sample

1 kilo gram for gamma spec

radon emission

Radium R-226 by chem. → $126.00

$168.00

50 grams

P.O. Box

7021 Pan American Highway NE

Albuq, New Mexico 87109

Labs

St. Louis Co. Lab
Dr. Black

Camp Dresser McKee
Earl Simmons
8/29/83

Accu Lab Research Inc.
11455 W. 48th Ave
Wheatridge Colo
303-423-2766

radiation ... tech.
- gamma spec
Eberline Inst. C
Dr. Chandra
505-345-346
8/29/83

Applied Physical Techno -

~~Symyrna~~ - Smyrna, George

Aware Inc
Nashville, Tenn

Jack Rad.

CH_2M-Hill
Redding, Calif

Controls for Env. Pollution Inc

Nuss?

9:0?

Ash Samples

Rec'd. 8/29/83 JHP

	1980	1981	1982	1983
Jan		4.3	2.5	7.8
Feb		3.9	2.7	5.6
M			3.0	2.9
A			3.4	5.51
M			2.8	8.10
J			2.0	
J		3.0	4.3	
A	3.0	2.7	2.2	
S	3.3	2.6	2.8	
O	2.9	3.4	4.2	
N	3.0	4.6	2.9	
D	3.9	5.1	4.8	

METROPOLITAN ST. LOUIS SEWER DISTRICT

July 17, 1986

Mr. Rod Melgard
Eberline Instrument Corporation
7021 Pan American Highway, N.E.
Albuquerque, New Mexico 87109

Dear Mr. Melgard:

As discussed with you on the telephone yesterday, we are requesting your firm to analyze six incinerator ash samples for Radium 226 by chemistry technique. These samples are being sent to you by United Parcel Service. The samples are designated as **"Angelica Street Ash, Bissell Point STP"** Nos. 1 through 6. We understand the cost of the chemistry analysis for Radium 226 is **$113.00** per sample. In billing us, refer to Purchase Order No. **P9754W.** Please forward your invoice and test results to Mr. Al Callier, Bissell Point STP, 10 E. Grand Avenue, St. Louis, Missouri 63147. I would also appreciate receiving a copy of the test results.

Thank you for your assistance with this request.

Sincerely,

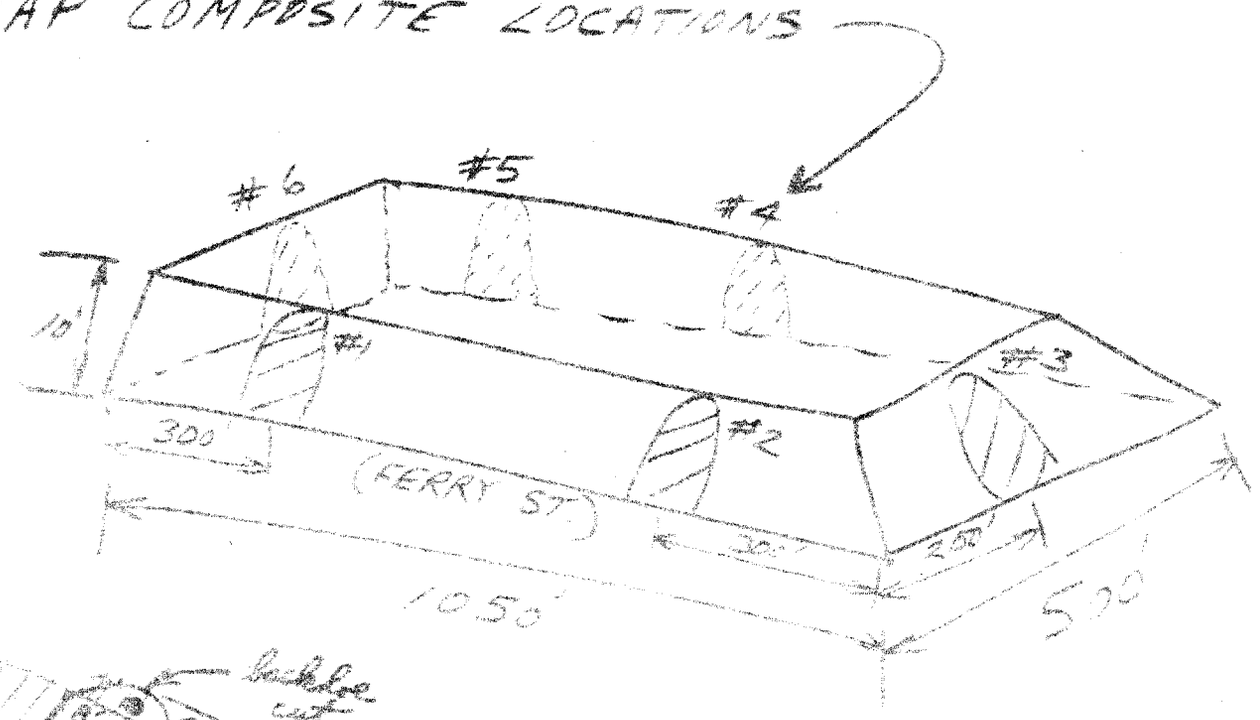
Bernard A. Rains, P.E., Director
Environmental Compliance

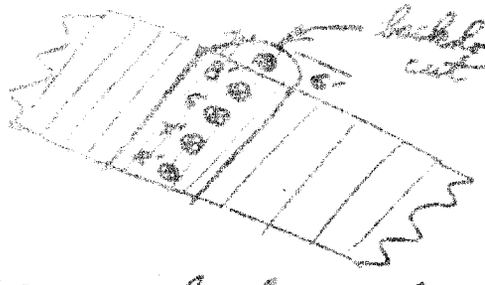
BAR:kat

cc: Roger Wieting
Al Callier

Paul
al
BHR
6/26/86

MAP COMPOSITE LOCATIONS





⊗ = equal volume grab

(5⊗ = 1 composite)*

* composite volume = 1 gal w/ good blending & split in half for shipment

ALBUQUERQUE LABORATORY

CUSTOMER: Metropolitan St. Louis Sewer Dist.
ATTENTION: Bissell Point STP
ADDRESS: Al Callier
CITY: 10 E. Grand Ave.
W.O. NO.: St. Louis, Missouri 63147
E-6162

REPORT OF ANALYSIS

Radium in incinerator Ash
TYPE OF ANALYSIS

P9754W
CUSTOMER ORDER NUMBER

SAMPLES RECEIVED 7/24/86

Customer Identification	Date Collected	Type of Analysis	Total Wt. (g) dry	pCi/g (dry)
#1BPSTP Ash Pile Angelica St. Ferry St.	7/9/86	Ra-226	647	1.2±0.2
#2BPSTP Ash Pile Angelica- Ferry St.	"	"	599	1.2±0.2
#3BPSTP Ash Pile Angelica- Ferry St.	"	"	648	0.6±0.2
#4BPSTP Ash Pile Angelica- Ferry St.	"	"	660	2.2±0.2
#5BPSTP Ash Pile Angelica- Ferry St.	"	"	659	0.5±0.2
#6BPSTP Ash Pile Angelica- Ferry St.	"	"	687	1.1±0.2

cc: Bernard A. Rains

☐ REPORTED VIA TELEPHONE

TMA Eberline
Thermo Analytical Inc.
7021 PAN AMERICAN FREEWAY, N.E.
ALBUQUERQUE, NEW MEXICO 87109
PHONE (505) 345-3461

APPROVED BY Rod Melgard, Mgr. 9/15/86 DATE

ALBUQUERQUE LABORATORY

CUSTOMER: METROPOLITAN ST. LOUIS SEWER DIST.
ATTENTION: PAUL BRACKENS
ADDRESS: 10 N. GRAND AVE.
CITY: ST. LOUIS, MO 63147
S.O. NO.: E-4225

REPORT OF ANALYSIS

Radiochemical analyses of ash.
TYPE OF ANALYSIS

P-7164
CUSTOMER ORDER NUMBER

SAMPLES RECEIVED 9/24/84

Customer Identification	Date Collected	Type of Analysis	pCi/g	Total Wt. (g)
simulated ash February (F Cake ashed in lab muffle furnace daily)	2/1/84 2/29/84	Ra-226	0.4±0.1	230
simulated ash August (F Cake ashed in lab, muffle furnace daily)	8/1/84 8/31/84	Ra-226	0.5±0.1	236

sent out by George Schillinger

Recd GTR 11/13/84

☐ REPORTED VIA TELEPHONE
☐ REPORTED VIA TWX

Eberline — A DIVISION OF Thermo Electron CORPORATION
P. O. BOX 3874 ALBUQUERQUE, NEW MEXICO 87190
PHONE (505) 345-3461 twx: 910-985-0678

APPROVED BY Chandrasekaran
CHANDRASEKARAN, E.S., MANAGER

11/9/84
DATE

METROPOLITAN ST. LOUIS SEWER DISTRICT

for Russell STP

September 11, 1984

Teledyne Isotopes
Attn: Mr. David Martin
50 Van Buren
Westwood, New Jersey 07675

Dear Mr. Martin:

We have mailed an ash sample to your laboratory for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is Destrehan Sewer - East Basin composite for the days of June 20 and 21, 1984. The enclosed ash composite sample weighs 238 grams and was prepared by lab-firing sludge at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 84-1032 is used in reporting. Please bill and report the results to Mr. B. A. Rains, Manager, Industrial Pollution Control, at the address below.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains BAR 9/13/84

METROPOLITAN ST. LOUIS SEWER DISTRICT

September 19, 1984

Teledyne Isotopes
Attn: Dr. David Martin
50 Van Buren
Westwood, New Jersey 07675

Dear Dr. Martin:

We have mailed an ash sample to your laboratory for analysis by "GC 5 Ge (Li) Gamma Spectroscopy of Solids Samples" analytical procedure. The sample was delivered to United Parcel Service today.

The sample is a Bissell Point simulated ash composite for the period June 1 through 30, 1984. The simulated ash composite sample weighs 219 grams and was prepared by lab-firing filter cake at 580°C. It might be helpful in maintaining sample identification if our MSD Lab No. 84-284 is used in reporting. Please bill and report the results to Mr. B. A. Rains, Pollution Control Manager, at the address below.

If there are any questions, please contact us.

Sincerely,

Leo Groseclose

Leo Groseclose
Industrial Waste Lab Supervisor

LG:kat

cc: B. A. Rains
George Schillinger

METROPOLITAN ST. LOUIS SEWER DISTRICT

August 29, 1983

Eberline Instrument Corporation
7021 Pan American Highway, N.E.
Albuquerque, New Mexico 87109

Gentlemen:

As a result of a telephone discussion with Dr. Chandra, we are requesting your firm to analyze two soil samples for Radium 226 by chemistry technique. The samples are designated as "January Ash Composite BPSTP," and "May Ash Composite BPSTP." We understand the cost of the chemistry analysis for Radium 226 is $126.00 per sample. In billing us, please refer to Purchase Order No. P-5331 WW. Please forward your invoices and test results to the undersigned.

Thank you for your assistance with this request.

Sincerely,

Bernard A. Rains

Bernard A. Rains, P.E., Manager
Industrial Pollution Control

BAR:kat

cc: George Schillinger
Leo Groseclose

505-345-3461

? Gamma Ray Spectroscopy

$113.00

UPS

ACKNOWLEDGEMENT

ALBUQUERQUE LABORATORY

CUSTOMER Metropolitan St Louis Sewer District
ADDRESS 10 East Grand ave
CITY St Louis, Missouri 63147
CUST. P.O. NO. P-5331 W/O CUST. S.O. NO.

PRELIMINARY DATA REPORT

TOTAL NO. OF SAMPLES 2 | DATE RECEIVED 9.2.83 | DATE DUE | WORK ORDER NO. E-2840

Bernard A. Kaus

ITEM	NO. OF SAMPLES	TYPE OF ANALYSIS
1	2	Ash - Radium 226

SAMPLE RECEIPT ACKNOWLEDGEMENT

LAB. NO.	CUSTOMER IDENTIFICATION	CUSTOMER SAMPLE NO.	DATE COLLECTED	TYPE OF ANALYSIS	TOTAL VOL. WT.	ALIQUOT	*	*
E-7772	January Ash Comp. BPStP			Ra 226				
73	May Ash Comp. BPStP			Ra 226				

* INSERT UNITS

Eberline — A DIVISION OF Thermo Electron CORPORATION

P. O. BOX 3874 ALBUQUERQUE, NEW MEXICO 87190
PHONE (505) 345-3461 twx: 910-985-0678

BY Gloria Madrid DATE 9.2.83

METROPOLITAN ST. LOUIS SEWER DISTRICT
INDUSTRIAL WASTE DIVISION
ROUTE SLIP

	Recipient	Init.	Date
	MANAGER		
	ASST. MANAGER		
	LAB SUPERVISOR		
	ENGINEER(Field)		
	ENGINEER(Admin.)		
	SECRETARY		
	TYPIST CLERK II		
	FILE:		
1	George Schillinger		

ACTION:

METROPOLITAN ST. LOUIS SEWER DISTRICT
INDUSTRIAL WASTE DIVISION
ROUTE SLIP

	Recipient	Init.	Date
✓	MANAGER		
	ASST. MANAGER		
	LAB SUPERVISOR		
	ENGINEER(Field)		
	ENGINEER(Admin.)		
	SECRETARY		
	TYPIST CLERK II		
	FILE:		
1	~~George Schillinger~~		

ACTION: comments?
What kind of sample

REPORT OF ANALYSIS

OCTOBER 5, 1984

is this? same as previously from Mallinckrodt (composite of discharged sludge)

What does it mean?

$27.4 \times \frac{2.5}{170} \simeq 0.5$ in influent

$0.5 \times$ (concentration factor) $\simeq$ (concen. in ash)?

Additional data? See

TELEDYNE ISOTOPES
50 Van Buren Ave., Westwood, New Jersey 07675
Phone: 201-664-7070 Telex 134474

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 10/04/84

	WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 1
MR BERNARD RAINS METROPOLITAN ST LOUIS SEWER DIST 10 EAST GRAND AVE ST LOUIS MO 63147	3-4054	LAB NO 84-1032	09/14/84	10/17/84	

S O L I D S

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (pCi/gm DRY)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
01366	84-1032 DSTRHN S E BN		06/20		06/21		FE-7	L.T. 6. E 00		10/03			4
							K-40	1.22+-0.33E 01		10/03			4
							MN-54	L.T. 3. E-01		10/03			4
							CO-58	L.T. 5. E-01		10/03			4
							FE-59	L.T. 2. E 00		10/03			4
							CO-60	L.T. 2. E-01		10/03			4
							ZN-65	L.T. 7. E-01		10/03			4
							ZR-95	L.T. 9. E-01		10/03			4
							RU-103	L.T. 1. E 00		10/03			4
							RU-106	L.T. 2. E 00		10/03			4
							I-131	L.T. 2. E 03		10/03			4
							CS-134	L.T. 3. E-01		10/03			4
							CS-137	L.T. 2. E-01		10/03			4
							BA-140	L.T. 8. E 01		10/03			4
							CE-141	L.T. 3. E 00		10/03			4
							CE-144	L.T. 2. E 00		10/03			4
→							RA-226	2.74+-0.45E 01		10/03			4
							TH-228	4.25+-0.43E 00		10/03			4

LAST PAGE OF REPORT

SEND 1 COPIES TO ME803S MR BERNARD RAINS

APPROVED BY H. KING H. King 10/04/84

2 - GAS LAB. 3 - RADIO CHEMISTRY LAB. 4 - Ge(Li) GAMMA SPEC LAB. 5 - TRITIUM GAS/L.S. LAB.

REPORT OF ANALYSIS

OCTOBER 5, 1984

TELEDYNE ISOTOPES
50 Van Buren Ave., Westwood, New Jersey 07675
Phone: 201-664-7070 Telex 134474

TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 10/04/84

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 1
3-4209	LAB NO 84-1032	09/24/84	10/27/84	

MR BERNARD RAINS
METROPOLITAN ST LOUIS SEWER DIST
10 EAST GRAND AVE
ST LOUIS MO 63147

S O L I D S

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (pCi/gm DRY)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
02255	MSD LAB NO 84-284		06/01		06/30		BE-7	L.T. 3. E 00		10/02			4
							K-40	1.81+-0.18E 01		10/02			4
							MN-54	L.T. 2. E-01		10/02			4
							CO-58	L.T. 3. E-01		10/02			4
							FE-59	L.T. 1. E 00		10/02			4
							CO-60	L.T. 1. E-01		10/02			4
							ZN-65	L.T. 4. E-01		10/02			4
							ZR-95	L.T. 4. E-01		10/02			4
							RU-103	L.T. 6. E-01		10/02			4
							RU-106	L.T. 1. E 00		10/02			4
							I-131	L.T. 4. E 02		10/02			4
							CS-134	L.T. 2. E-01		10/02			4
							CS-137	4.21+-1.24E-01		10/02			4
							BA-140	L.T. 2. E 01		10/02			4
							CE-141	L.T. 1. E 00		10/02			4
							CE-144	L.T. 8. E-01		10/02			4
							RA-226	L.T. 3. E 00		10/02			4
							TH-228	L.T. 4. E-01		10/02			4

LAST PAGE OF REPORT

APPROVED BY H. KING 10/04/84

SEND 1 COPIES TO ME803S MR BERNARD RAINS

2 - GAS LAB. 3 - RADIO CHEMISTRY LAB. 4 - Ge(Li) GAMMA SPEC LAB. 5 - TRITIUM GAS/L.S. LAB.

RMC Technical Services

3508 Market Street • P.O. Box 7940 • Philadelphia, PA 19104 • 215-243-2950 • TWX 710-670-1989 • CABLE: RMCPHIL

January 17, 1983

Metropolitan St. Louis Sewer Department
Ten East Grand Avenue
St. Louis, MO 61347
Attn: Mr. Bernard Rains

Dear Mr. Rains:

In the interest of improved customer service, RMC has decided to phase out its radiochemical laboratory services business and concentrate on emergency medical support, health physics, and environmental and related consulting services. To assure continuity of all programs, we recently signed a cooperative agreement with Teledyne Isotopes of Westwood, New Jersey, whereby RMC and Teledyne Isotopes will work together to shift RMC's analytical laboratory analysis capabilities to Teledyne during the next year. We expect that the combined laboratories will meet all present and future customer needs with regard to both analytical quality and the requirement for timely reports of data.

Services affected by this agreement include the radiochemical analyses of environmental samples, in-plant radiochemistry analyses, routine chemical bio-assays, and the laboratory and program management of Radiological Environmental Monitoring Programs (REMP). RMC will retain a laboratory to support our Emergency Medical Program.

Teledyne has purchased the assets of the laboratory and will operate out of the RMC facility for up to one year. RMC and Teledyne will cooperate to effect a smooth transition of work and to ensure that our customers are not inconvenienced.

RMC plans to assign or subcontract all work orders to Teledyne. If you have any objection or have any questions regarding this transition, please contact Mr. Paul Harmon, General Manager, RMC Eastern Technical Services; Dr. Charles McGee, RMC Laboratory Director; or me. I have enclosed a brochure describing the capabilities of Teledyne Isotopes and a Teledyne Quarterly Report which featured Teledyne Isotopes. Although the report is from 1981, it accurately reflects the basic capaillities and operating philosophy

RMC Technical Services

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of the company. Any questions regarding Teledyne should be directed to Dr. Donald Schutz or Dr. David Martin of Teledyne at 201-664-7070.

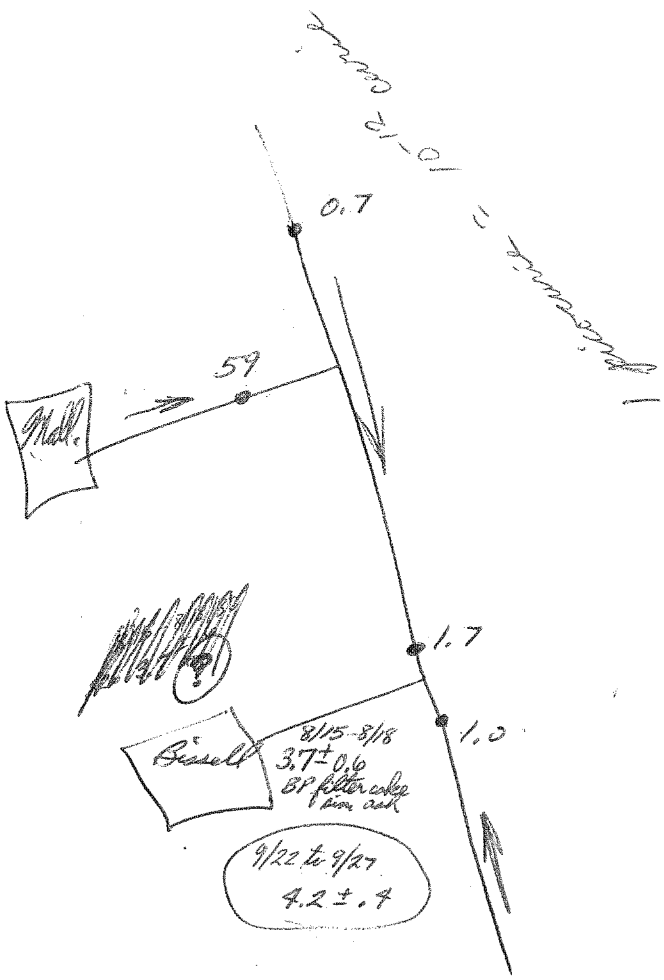
Sincerely,

RADIATION MANAGEMENT CORP.

Richard T. McKernan

Richard T. McKernan
Chief Executive Officer

amp
Enclosures


0.7
59
1.7
1.0
Bissell
8/15-8/18
3.7± 0.6
BP filter cake
9/22 to 9/27
4.2 ± .4

Radiation Management

Taped Conversation on 11/4/80 @ 1510 hours

BOOTH: Bernie, this is Lee Booth

RAINS: Hi, Lee

BOOTH: Let's see, I was going to call you today and we're going to talk about EPA regs. at the meeting? Right?

RAINS: Right

BOOTH: I talked to the guy, Bob Augustine with EPA this morning. He can tell me the EPA does not contemplate changing any of their recommended guidelines for radium 226.

RAINS: In other words, the 5 ....

BOOTH: In terms of the 5 picocuries per gram. Right!

RAINS: That's going to stay that way?

BOOTH: So far as he knows, right. He knows of no indication within the agency to change that to raise it to 15 or something like that.

RAINS: An what's his position?

BOOTH: I don't know what his official title is.

RAINS: O.K.

BOOTH: I can get that for you. We will document that.

RAINS: O.K.

BOOTH: As part of our information to you. He also was, well his next, very next comment before I said anything more was that "However, in almost all instances State Regulations apply to most people in on terms of regardless of what EPA recommended as guidelines. The States were implementing their own mandatory regulations and then usually they look consistent with the five picocuries per gram. So then this is probably the case here. So from that standpoint ---

RAINS: You didn't tell him, who, of course

BOOTH: No, I didn't tell who you were or where you are I just said simply that that for our client that appeared to be the case. ~~They~~ appear to implementing EPA guidelines or recommendations in their rules and regulations.

As far as the Mallinckrodt's proposal to releasing materials. We've looked at the letter, and of course, we need more information before we can confirm any of their claims ...

RAINS: What type of information do you need?

BOOTH: Well, first, so far as I can see in their letter they haven't indicated any kind of total activities that they intend to release. Unless they provided them to you.

RAINS: No they haven't.

BOOTH: Certainly, you know they're going to release a portion of the sludge on a daily basis is something we'd have to have, what kind of activities, what kind of concentrations or whatever they intended to release. They need to supply that and then we'd need total volume, ~~pollution facts~~ dilution factors and whatever that kind of thing is going into.

RAINS: Total volume of their solids plus

BOOTH: Plus whatever they're releasing into their system plus total volumes of the ash that's generated. Whatever it'll be ....

RAINS: During that period. Right!

BOOTH: Right! During that period. During the period of release.

RAINS: O.K.

BOOTH: And, of course, our initial response is that their, if according to their level ashes that say 3 picocuries per gram. Plus or minus a gram. And they're going to add another picocurie per gram to it. They're pushing 5 picocuries per gram. But that can't, again that's just based on what they say and we can't really confirm that until we get ...

RAINS: Right. Do you have the results of the ash sample that we gave you from Bissell at the same time that, you know, we gave these samples that you gave me the results at Branch?

BOOTH: I do not have those right now, and anything other than what I got from the labs yesterday. However, she indicated that they should coming out this week with all the results.

RAINS: Would it be possible to get that one, what in our ash that compares with the Destrehan, and Branch Street and Withers and all that.

BOOTH: Yea, what's in the final ash as it comes out.

RAINS: Yea, from the plant, here. Not necessarily the ones that we sent you that we'd sent to NUS.

BOOTH: Right, right. But the one that would be the summation of all the interceptor ash.

RAINS: Yea, right.

BOOTH: Yea, I'll try and get that one.

RAINS: If you can get that one, call me with that number. We need that before our meeting. We've got another meeting with them Thursday.

BOOTH: O.K., I'll try and get that this afternoon. If I can't, or if, I'm not sure that they're going to be able to give me the number exactly this afternoon, they may be able to generate it by tomorrow, let's say. I will have either Lou Carson or John Woody get it for you and call you.

RAINS: O.K.

BOOTH: Get that down to you, try and get it to you before Thursday.

RAINS: Can you give me any advise for Thursday. Mainly what we are going to do is tell them our position and state that we're going to need more information in order to make a decision, but that we're not too receptive to going above that 5.

BOOTH: Yea, right. O.K. that's pretty much what our advise would be right now. Based on what we know right now, it certainly is not in your best interest to generate any waste to to go above 5 picocuries per gram. And that based on at least the very initial preliminary information that Mallinckrodt has submitted, you have no basis for doing anything other than taking their word of what they are going to do is going to keep us below 5 picocuries per gram.

RAINS: That's right. We were thinking about having them check on weekly composites and having them run the analysis with split samples to you on what the level was during their discharge to insure that we were not going above that.

BOOTH: O.K., yea I would, it would be certainly in your best interest to, I think look little closer and perhaps at the information, the data they used and the calculations they used to estimate that their rates of release are going to keep the ash below 5 picocuries per gram. And to confirm those numbers before you certainly make any effort to approve their releases. And then as you say maintain them with some sort of periodic monitoring system to varify that what they're doing is what they said they were going to do. Certainly we don't want to be put in the position of generating, if 5 picocuries per gram of hazardous waste you don't want to be put in the position of knowing generating this waste.

RAINS: That's right, that's absolutly right.

BOOTH: And so long as you can have some ability to control the inputs to the system, but I'm sure that they can release it at such a rate, whatever that rate is to keep the level significantly below 5 picocuries per gram. It's just that we or you, I don't think have sufficient information to varify that what they are going to do will indeed meet that criteria. I THInk you should request whatever information or data they used to calculate that----------? their proposed release rates will indeed be below the limits of concern; will result in concentrations determined below the limits you are concerned with.

RAINS: O.K. Got any idea on if we do take it what kind of charges we might consider? I don't know how much it costs to get rid of a low level radioactive waste.

BOOTH: Do You mean in terms of cost of disposaing of it as waste.

RAINS: Yea, let's say that they went above it, you know, something, and now we've got it in our plant. How much does it cost to dispose of that? Where do you have take it?

BOOTH: O.K. What you have to do, as long as it's radioactive waste, and as long as it's classified as that, you'd probably have to drum it, or box it up in some sort of containier, it certainly would be considered "low specific activity" waste which is about the lowest category of waste that you can ship so that you wouldn't have to have huge shipping containers, or anything like that, but I think you would have to have containers that meet the specification requirements from the Department of Transportation for shipping waste. It would have to be certified as so and shipped as such.

RAINS: Even though it's just a little above the 5?

BOOTH: Right, even though ~~might even though~~ just.....
...

RAINS: Gee Wiz!

BOOTH: Yea

RAINS: So you're talking about a very costly operation.

BOOTH: Very costly, you'd have to go to a commercial disposal ground, either in Barnwell, South Carolina or out in Nevada. So you're talking about significant, transportation the actual waste burial cost are not very large ~~cost are not very large~~ but the process of boxing or ~~either~~ drumming it or whatever and shipping it out there is going to be very expensive. And especially if you have large volumes, such as what you're talking about. As so it's not a trivial consideration, that's for sure.

RAINS: And what you're telling me then, with the piles that we have, I'm reading something into what you are saying here, with the piles that we have, we have real problem.

BOOTH: If you can not get some sort, if you have to treat it as radioactive material, dispose of it as radioactive waste, yes, that is a ~~hazardous~~ you have a significant, a potentially signicant and costly problem.

RAINS: Should we be contacting some regulatory agency right now, like EPA, and explaining our problem, or what?

BOOTH: No, I don't think so, we don't believe that that's necessary now, it is not from a licensing standpoint or a regulatory standpoint. The materials are not sufficient to require warrant notification.

RAINS: And you have'nt time to review the Missouri

BOOTH: Have'nt really had time to look at the Missouri radiological regulations in terms of what, although there may very well be some notification required there, I hope to find that out very soon.

RAINS: I'm concerned about if we even ship even one load of this material like off our site knowing that it's above a certain level. You suggest not moving any of it.

BOOTH: I would suggest certainly not moving any of it to properties that our not yours. Certainly because of the thing in concern, that I would recommend, at least right now, just sitting still with it until everything is pretty well defined in terms whether or not it's classified radioactive material by the State and that may very well be different than classifying it as hazardous waste from the State EPA people. The radiological people may not even consider it as radioactive material, but I think they will. At 5 picocuries per gram or Whatever it might be.

RAINS: O.K, Well that's about it then.

BOOTH: Yea, I guess our recommendation is to get more information from MALLINCKRODT as much as you can to verify that you don't be generating more hazardous waste. Unless you're willing to live with their assurance - - -

RAINS: No, we're not willing to do that.

BOOTH: I would'nt be either. Because as we discussed, that could turn out to be a very significant expensive cost, if not a hazard certainly significant - - -

RAINS: O.K., Lee, well thank you very much, and we'll be hearing from you, I guess

BOOTH: Right, I'll be out of town, but I'll try and get started on this, at least this one additional analysis of the Bissell Point Ash and get that to you by tomorrow or by Thursday. Hopefully

RAINS: ~~I~~ And then you all will be getting back to us on the total project of what we should be doing and so on.

BOOTH: Right.

RAINS: O.K.

BOOTH: O.K.

RAINS: Very Good

BOOTH: Alright, Bernie, ~~All right~~ talk to you later.

RAINS: Thank you.

BOOTH: Bye

RAINS: Bye

December 12, 1980

Mr. Bernard A. Rain, P. E.
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand
St. Louis, Missouri 63147

Dear Mr. Rains,

Pursuant to our meeting with Metropolitan St. Louis Sewer District (MSD) representatives on December 5, 1980, and in conjunction with our ongoing consulting work with your organization, Radiation Management Corporation (RMC) has reviewed the proposed Mallinckrodt, Inc. discharge of low level radioactive waste to the MSD sewer system. We have also studied pertinent regulatory requirements concerning this proposed action.

Based on the results of our studies, RMC recommends that MSD not accept additional radioactive waste from Mallinckrodt at this time. The bases for this recommendation are provided below:

A. U.S. Nuclear Regulatory Commission (NRC) regulations require that lisensed material discharged to a sanitary sewage system be "...readily soluble or dispersible in water..." (10CFR20.303). The NRC has not defined in the regulations "readily soluble" or "dispersible", so the actual meanings are somewhat unclear. However, based on common usage and based on verbal discussions with the NRC Standards Branch, a procedure which "flushed solids from the basin using a fire hose" would not likely be considered readily soluble or dispersible in water. A representative from Inspection and Enforcement Branch also indicated that materials requiring mechanical agitation to remain in suspension have not in the past been considered "dispersible". We recommend that MSD obtain an official definition from the NRC for these terms, and ask Mallinckrodt to demonstrate compliance before discharging additional material.

B. We are aware of a recent decommissioning requirement to a current licensee setting a target decontamination criteria for soil of 5pCi/g(Ra 226) and 35 pCi/g (U-238). The NRC did say that if this can be met only at unreasonable expense, the matter would be reviewed on a case by case basis. If these criteria are interpreted to be applicable in the future to MSD, then this would result in an expensive disposal operation for MSD. We recommend that a clarification from the NRC be obtained before MSD increases its liability further by accepting any more Mallinckrodt material.

FRAZIER L. BRONSON, C.H.P.
Vice President, Nuclear Services

radiation management corporation

3508 MARKET STREET
PHILADELPHIA, PA 19104
(215) 243-2950

C. The state of Missouri Division of Health, Radiation Protection Regulations, require that "every person who receives radioactive waste material for holding and preparation prior to disposal, shall first obtain a permit from the Division of Health for such holding and preparation." These regulations are also not totally clear, and the possibility exists that any quantity exceeding "Exempt Quantities" (for Radium 226 = 0.1 μCi) might be considered radioactive waste. RMC recommends that the exact permit requirements be determined from the Division of Health before additional radioactive materials are knowingly accepted from Mallinckrodt.

D. Mallinckrodt has indicated that MSD ash containing Ra 226 in excess of 5 pCi/g does not qualify as "hazardous waste", either under the Resource Conservation and Receovery Act (RCRA) or the Missouri Hazardous Waste Management Law (MHWML). This opinion is based on the definition of "hazardous waste", which applies only to materials with characteristics of a) ignitability, b) corrosivity, c) reactivity, and d) EP toxicity. Hence, radioactivity, by itself, is not a characteristic which classifies a waste as hazardous, under the present regulations. However, proposed rulemaking would define waste as hazardous if Ra 226 exceeded 5 pCi/gram average concentration (43FRNO.243, 12/18/78). RMC has determined that radioactivity will soon be added to these definitions, although the final Ra 226 number may be as high as 15 pCi/gram. Thus, it is uncertain what MSD's liability will be concerning the ash already present containing greater than 5 pCi/gram Ra 226. RMC recommends that MSD not accept additional Ra 226 waste from Mallinckrodt until the liability for the material already in MSD's possession can be better defined.

E. The MSD system is a combined sewer system servicing process waste, sanitary waste and storm sewer waste. The NRC regulations specify "sanitary sewerage system(s)" when addressing discharges of licensed material. It is believed that your combined sewer system meets the intent of the regulations, but we recommend that before accepting additional waste, MSD confirms if their system falls within the intended scope of the NRC regulations, and therefore, if authorized discharges are applicable to the MSD system.

Metropolitan St. Louis Sewer District

As we discussed, RMC will pursue these questions on behalf of MSD as per previous agreements.

If there are any question, please call this office.

Sincerely,

Frazier L. Bronson, C.H.P.
Vice President

FLB:kgc

Summary

Mallinckrodt

1. uncertain liability w/ respect to Mo. Div. of Health
2. solubility (only accept soluble radioactivity) ← soluble
3. sanitary sewer vs. combined sewer (to sanitary only)
4. if defined as ☆ by State (anyone who receives ? permit)
5. dilution of Bissell pile with lower level influent

rmc

radiation management corporation

Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062
(312) 291-1030

September 22, 1980

Mr. Bernard Rains, P.E.
Manager, Industrial Pollution District
Metropolitan St. Louis Sewer District
2000 Hampton Avenue
St. Louis, Missouri 63139

9/26/80

Dear Mr. Rains,

This letter is in response to your request at our meeting of September 12, 1980, between yourself, Mr. Schillinger, Lee Booth, and myself. At that meeting we discussed a sample regime designed to gather preliminary information to determine the source of the apparent increased levels of Ra-226 at the Bissell Point versus the Lemay facility.

Your people will collect (and document) representative samples of the input to the processing plants, plus a representative output sample of that time period. These samples will be prepared in your lab (dried and incinerated) in a manner to be consistant with the actual plant processing conditions. The samples should be 1 kg (preferably) but at least 500 g. We also recommend the re-analysis of a representative number of the samples analyzed by NUS. This should be 3 or 4 samples from each plant. We also recommend that you submit several samples of current representative liquid effluents from the plant to confirm conformance with guidelines. These should be about 1 gallon. Samples should be clearly labeled on the individual sample container, and on a separate sample identification list. A copy of the sample identification list should be sent to Lee Booth, Chicago. The samples should be sent to Philadelphia, attention, Analytical Laboratory. Analytical Procedure GC5 Ge(Li) Gamma Spectroscopy of Solid Samples, should be requested for the ashed samples (cost = $50/sample) and procedure RØ3, Analysis of Water Sample for Ra-226 by Rn Emanation, for the liquid samples (cost = $40/sample). The sample turn-around time is 30 days. Faster sample turn-around is available, but at additional cost.

You also requested to be formally notified of RMC's charges. They are as follows:

Lee Booth

Personnel Consulting Rates

	Hourly Rate ($)
Senior Medical Consultant	$100.00
Medical Consultant	85.00
Senior Professional Consultant	85.00
Senior Consultant	60.00
Senior Scientist	47.00
Scientist	37.00
Associate Scientist	26.00
Senior Technician	21.00
Technician	18.00
Junior Technician	13.00

Invoices will reflect the person doing the work, the date the work is performed, and will separate travel time from consulting time.

Outside Expenses - These are billed at cost for transportation and lodging, and cost plus 15% for all other.

Terms - Net 15 days, service charge of 1½% per month after 30 days.

We also discussed, and still recommend, that RMC begin preparation of a report summarizing the applicable radioactivity regulations concerning the disposition of the sludge. This is recommended to commence prior to the written receipt of the NUS data or the RMC lab results, in order to expedite future reports. This is estimated to involve 17 man-days at an estimated cost of $6720. This project is now underway.

The necessity and type future work would then be determined, as a result of the preliminary sample analyses. Discussed were tasks related to evaluation of dilution prior to disposal, further evaluation of the source of input of the Ra-226 or plant processing concentration, tasks related to the applicability of the 5pCi/g limit, tasks related to the granting of a exemption from the limit, and ~~tasks related to the granting of a exemption from the limit~~, and providing information on various industrial categories which concentrate natural radioactivity as a byproduct of their operation.

I trust this letter correctly summarizes our meeting and projects.

Sincerely,

Frazier L. Bronson, C.H.P.
Vice President

FLB:kgc

METROPOLITAN ST. LOUIS SEWER DISTRICT

October 13, 1980

Mr. Lee Booth
Radiation Management Corporation
Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062

Dear Mr. Booth:

We have reviewed the information contained in Mr. Frazier Bronson's letter dated September 22, 1980. As you know, we have mailed several ash samples to your Philadelphia Lab for recommended analyses. Unfortunately, a sample from our Lemay Treatment Plant was not included in that mailing. We are presently obtaining another sample of our Lemay ash and will submit that to your Philadelphia Lab for comparative analysis.

We are meeting with representatives from the Mallinckrodt Chemical Company Monday, October 13th to discuss the NUS data and report. Once we have this information we will forward a copy to you.

We are in agreement with the course of action recommended in Mr. Bronson's letter. As we understand, for the $6,720 estimated for the first phase of this project, you will provide the following services:

1. Review appropriate Federal, State of Missouri, and State of Illinois regulations pertaining to disposal of low-level radioactivity.

2. Analyze the reported information from NUS with respect to, accuracy and applicability to our disposal and source location problems.

3. Evaluate the results of the analyses performed on samples submitted to your Philadelphia Lab with respect to disposal and source location alternatives.

4. Prepare a written report on your findings and evaluations which will include:

   a. An evaluation of possible disposal alternatives.
   b. Need for future source location studies.
   c. Applicability of the current regulatory limits to our disposal or reuse alternatives.

d. Possible action to take in obtaining a regulatory exemption.
e. Information on potential industrial categories which concentrate natural radioactivity as a by-product.
f. Recommendations concerning future work direction and effort.

If the above referenced plan of study does not match your assessment of this project, please call us so that modifications can be negotiated.

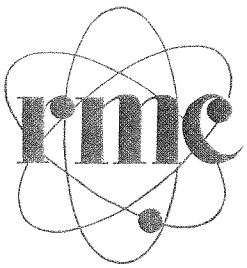
Sincerely,

Bernard A. Rains

Bernard A. Rains, P.E., Manager
Industrial Pollution Control

BAR:kat

cc: C. B. Kaiser
R. S. Flick
R. Wieting



December 18, 1980

Mr. Bernard A. Rains, P.E.
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand Avenue
St. Louis, Missouri 63147

BAR 12/29/80

Dear Bernie,

Enclosed is a draft letter to the state defining the MSD situation and requesting an official ruling concerning a radioactive waste material permit. We recommend you revise this letter as needed and submit it to the state as soon as possible.

I have also enclosed invoices issued from our labs for sample analyses and from accounting for some of our labor and expenses.

If there are any questions, please call.

Sincerely,

Lee Booth

Leroy F. Booth, C.H.P.
Manager, Midwest Regional Office

LFB:kgc

Enclosures

radiation management corporation

Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062
(312) 291-1030

DRAFT

Mr. Kenneth V. Miller
Administrator, Bureau of Radiological Health
1511 Christy Lane
P. O. Box 570
Jefferson City, Missouri 65101

Dear Sir,

We were recently notified by a user of our system (Mallenckrodt, Inc.) that this user has been disposing of small quantities of radioactive materials by discharge to the MSD sewer system. The source of this radioactivity is ore processed by Mallinckrodt in the manufacture of Columbian and Tantalum salts. This ore contains small amounts of uranium and thorium and their daughters, which are disposed of by flushing to the sewer. This material appears to be insoluble, and as a result, is concentrated in the sludge incinerator ash generated at the MSD Bissell Point Plant. As a result of this process, MSD is presently in the possession of several hundred thousand cubic yards of ash containing anywhere from 3 to 10 pCi Ra 226 per gram of ash.

Upon learning of this situation, MSD initiated a study of all applicable rules and regulations concerning receipt, possession and disposal of radioactive material. In the course of this study, MSD has reviewed the Missouri Division of Health rules and regulations for radiation protection. Under Section 12 - Disposal of Radioactive Wastes, Paragraph (b) requires a permit from the Division of Health for the receipt of radioactive waste material for holding and preparation, prior to disposal. Since the term "radioactive waste material" is undefined, MSD is unable to determine whether a permit is required under these rules.

Therefore, MSD requests the Bureau of Radiological Health, Division of Health, to determine if the material in MSD's possession is "radioactive waste material" as specified in the rules and regulations, and if so, whether a permit is required from the Division of Health.

Sincerely,

rmc

radiation management corporation

Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062
(312) 291-1030

Mr. Bernard Rains
Manager, Industrial Pollution Control
Metropolitan St. Louis Sewer District
10 East Grand Avenue
St. Louis, MO 63147

Dear Bernie

In response to discussions held during our meeting on July 21, RMC offers the following consultation regarding receipt of material from Mallinckrodt, Inc. containing elevated levels of Ra-226.

MSD should verify that Mallinckrodt, Inc. releases are within all applicable regulatory limits. Although RMC questions the interpretation of "dispersibility" that Mallinckrodt has applied to their releases, we believe MSD will satisfy its liability for receipt of this waste by obtaining a clear, unequivocal statement from Mallinckrodt, Inc. that their releases are consistant with all applicable rules and regulations.

In addition, RMC recommends that no discharge be allowed that would cause the MSD ash Ra-226 content to exceed 5 pCi/g. We further recommend that a continuous sampling system be maintained to assure that ash generated at the Bissell Point plant does not exceed 5 pCi/g Ra-226.

I hope this resolves your questions concerning receipt of the Mallinckrodt waste. If you have additional questions, please call.

Sincerely,

Lee Booth

Leroy F. Booth, C.H.P.
Manager, Midwest Regional Office

LFB:kgc

cc: F.L. Bronson

Bissell Point STP

To: Mr. Wieling

MISSOURI DEPARTMENT OF NATURAL RESOURCES
P.O. Box 1368 1915 Southridge Drive Jefferson City, Missouri 65102 (314) 751-3241

October 2, 1981

Mr. Marlin J. Veesaert
General Aggregate Corporation
401 N. Lindbergh Blvd.
St. Louis, MO 63141

Dear Mr. Veesaert:

This is in response to a special waste disposal request for incinerator ash from the Metropolitan St. Louis Sewer District Bissell Point Treatment Plant. The request is to dispose of 140,000 cubic yards initially, and 40,000 cubic yards per year thereafter, at the Rock Hill Quarries Demolition Landfill. This request is approved with the condition that this material be handled and covered after disposal so as to minimize the potential for dust problems.

If you have any questions regarding this matter, please contact us.

Sincerely,

Thomas C. Pauling

Thomas C. Pauling
Environmental Engineer
Technical Services Section
Solid Waste Management Program

TCP/jas

cc: Mr. Mike Duvall, St. Louis Regional Office
Mr. George Schillinger, Metropolitan St. Louis Sewer District

cc: Flick
Kaiser
Rains ✓ 10/1/81

Rock Hill has been approved for ash disposal.

R. W.

Christopher S. Bond Governor
Fred A. Lafser Director

Division of Environmental Quality
Robert J. Schreiber Jr., P.E. Director

MSD-7.2

MEMORANDUM

METROPOLITAN ST. LOUIS SEWER DISTRICT

3-20 19 81

Bernie

Projected Costs for Radiation Management until July 1, 1981.

G.W.

$11,000

BK 3/25/81

By:

re: invoices

rmc

February 2, 1981

Mr. Bernard Rains
Metropolitan St. Louis Sewer District
10 East Grand
St. Louis, MO 63147

BAR 2/4/81

Dear Bernie,

Attached is a chronological listing of RMC charges incurred during our work for MSD, through this date. Individuals involved in this project, besides Frazier and myself, are Steve Brown, Manager, Western Regional Office, John Mucci, Midwest Regional Office Senior Technician, and Lew Karchner, Midwest Regional Office Health Physicist. Steven was asked to do the review of regulations due to his familiarity with the EPA regs, and John was involved with the literature searches.

All invoices generated by our Philadelphia Office should reflect the attached schedule. Please contact me if there are any apparent errors, since invoices are occasionally issued without my review. As an example, the invoice showing hours for JM on 10/28, 10/30 and 10/31 were charged at the wrong rate ($47/hr instead of $21/hr). As a result, Philadelphia is issuing a credit memo for the difference.

If there are any questions, please call.

Sincerely,

Lee Booth

Leroy F. Booth, C.H.P.
Manager, Midwest Regional Office

LFB:kgc

Enclosure

radiation management corporation

Midwest Division
3356 Commercial Avenue
Northbrook, Illinois 60062
(312) 291-1030

Charges

Date	Hours	Individual	Service
9/12/80	8 7	L. F. Booth F. L. Bronson	Meet with MSD at St. Louis
9/22/80	2	F. L. Bronson	Establish Project - Write B. Rains Outling Proposed Work
10/28/80	2	J. M. Mucci	Literature Search for Regs
10/30/80	3	J. M. Mucci	" " " "
10/31/80	3	J. M. Mucci	" " " "
11/3/80	1 5 8	L. F. Booth J. M. Mucci S. H. Brown	Establish Review Project Review Applicable Regs " " "
11/4/80	2 1.5	J. M. Mucci S. H. Brown	" " " " " "
11/7/80	1	L. F. Booth	" " "
11/12/80	3	S. H. Brown	" " "
11/13/80	6	S. H. Brown	" " "
11/14/80	6	S. H. Brown	" " "
11/17/80	8	S. H. Brown	Prepare Report on Reg Review
11/18/80	6	S. H. Brown	" " " " "
11/19/80	3	S. H. Brown	" " " " "
11/24/80	6	L. F. Booth	Review Mallinckrodt Proposed Releases
11/26/80	2	F. L. Bronson	Summarize RMC Recommendations
12/4/80	3	L. E. Karchner	
12/5/80	5 8	L. F. Booth F. L. Bronson	Meet with MSD at St. Louis " " " " " "
12/11/80	1	L. F. Booth	Letter to B. Rains with recommendations
12/18/80	2	L. F. Booth	Contact State of Missouri, letter to B. Rains

Charges, cont.

1/24/81	3	L. F. Booth	Phase I Report
1/26/81	4	L. F. Booth	" " "
1/27/81	4	L. F. Booth	" " "
	8	S. H. Brown	Report on Industrial Uses
1/28/81	3	L. F. Booth	Phase I Report
	8	S. H. Brown	Report on Industrial Uses
1/29/81	2	L. F. Brown	Phase I Report
1/30/81	2	L. F. Booth	" " "

Expenses

9/12/81	$393.08	FLB	Travel to St. Louis for MSD
	$165.63	LFB	Meeting
11/2/81	$544.01	SHB	Travel to RMC Midwest Regional Office for MSD Reviews
12/5/81	$170.00	LFB	Travel to St. Louis for MSD Meeting

Lab Costs

$1440.00

LABORATORY INVOICE

RADIATION MANAGEMENT CORPORATION
UNIVERSITY CITY SCIENCE CENTER
3508 MARKET ST.
PHILADELPHIA, PA. 19104
(215) 243-2950

DATE: 12/15/80

INVOICE #: LD2082

METROPOLITAN ST. LOUIS SEWER DISTRICT
2000 HAMPTON AVE.
ST. LOUIS, MO. 63139
ATTN: MR. BERNARD RAINS

CHARGES FOR ANALYTICAL SERVICES FOR
THE PERIOD 12/ 1/80 TO 12/15/80 PER
ATTACHED PAGES 1 THRU 1.

TOTAL CHARGE:

$ 40.00

PLEASE PAY
THIS AMOUNT

TERMS: NET 15 DAYS
SERVICE CHARGE:
1 1/2% PER MONTH
FOR EACH MONTH
OUTSTANDING BEYOND
15 DAY NET PERIOD

ALL REMITTANCES SHOULD
BE FORWARDED TO:
RADIATION MANAGEMENT CORP.
P.O. BOX 8068-5107
PHILA., PA 19177

CUSTOMER-ID	REC-ID	STOPDATE	DATE OF ANALYSIS	DATE OF REPORT	UNIT PRICE
ANALYSIS OF WATER SAMPLES FOR RADIUM-226 BY RN EMANATION					
SE/SWA/WESTLAKE	40488R03	11/12/80	12/ 4/80	12/ 9/80	40.00

LABORATORY INVOICE

RADIATION MANAGEMENT CORPORATION
UNIVERSITY CITY SCIENCE CENTER
3508 MARKET ST.
PHILADELPHIA, PA. 19104
(215) 243-2950

DATE : 2/15/81

INVOICE #: L02216

METROPOLITAN ST. LOUIS SEWER DISTRICT
10 E. GRAND AVE.
ST. LOUIS, MO 63147
ATTN: MR. BERNARD RAINS

CHARGES FOR ANALYTICAL SERVICES FOR
THE PERIOD 2/ 1/81 TO 2/15/81 PER
ATTACHED PAGES 1 THRU 1

TOTAL CHARGE

$ 260.00

PLEASE PAY
THIS AMOUNT

TERMS: NET 15 DAYS
SERVICE CHARGE:
1 1/2% PER MONTH
FOR EACH MONTH
OUTSTANDING BEYOND
15 DAY NET PERIOD

ALL REMITTANCES SHOULD
BE FORWARDED TO:
RADIATION MANAGEMENT CORP.
P.O. BOX 8068-5107
PHILA., PA 19177

RADIATION MANAGEMENT CORPORATION
UNIVERSITY CITY SCIENCE CENTER
3508 MARKET STREET
PHILADELPHIA, PA. 19104
(215) 243-2950

INVOICE TERMS: ----------NET/

****

INVOICE NUMBER: C00476

DATE: 2/ 4/81

P.O. NBR: LTR 92280

FACILITY: RMC STAFF SERVICES

METROPOLITAN ST. LOUIS SEWER DISTRICT
10 E. GRAND AVE.
ST. LOUIS, MO 63147
ATTN: MR. BERNARD RAINS

SERVICE DATE	EMP		TYPE OF SERVICE		SERVICE CATEGORY
11/ 3/80	SHB	192	SR. CONSULTANT	7 1	PROFESSIONAL CONSULTING
11/ 4/80	SHB	192	SR. CONSULTANT	7 1	PROFESSIONAL CONSULTING
11/12/80	SHB	192	SR. CONSULTANT	7 1	PROFESSIONAL CONSULTING
11/13/80	SHB	192	SR. CONSULTANT	7 1	PROFESSIONAL CONSULTING
11/14/80	SHB	192	SR. CONSULTANT	7 1	PROFESSIONAL CONSULTING
11/24/80	LFB	62	SR. SCIENTIST	7 1	PROFESSIONAL CONSULTING
12/ 4/80	LEK	69	ASSOC. SCIENTIST	7 1	PROFESSIONAL CONSULTING
12/ 5/80	FLB	59	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
12/ 5/80	FLB	59	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
12/ 5/80	FLB	59	SR. CONSULTANT	7 1	PROFESSIONAL CONSULTING
12/ 5/80	FLB	59	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
12/ 5/80	FLB	59	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
12/ 5/80	FLB	59	TRVL. EXP.:LODG.	7 1	PROFESSIONAL CONSULTING
12/ 5/80	LFB	62	SR. SCIENTIST	7 1	PROFESSIONAL CONSULTING
12/ 5/80	LFB	62	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
12/ 5/80	LFB	62	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
12/11/80	LFB	62	SR. SCIENTIST	7 1	PROFESSIONAL CONSULTING
12/12/80	FLB	59	SR. CONSULTANT	7 1	PROFESSIONAL CONSULTING
12/18/80	LFB	62	SR. SCIENTIST	7 1	PROFESSIONAL CONSULTING

BEGINNING 2/19/81 AND EACH FIFTEEN DAYS THEREAFTER AN INTEREST CHARGE OF 1.

S: ----------NET/15

****

: C00475

92280

STAFF SERVICES

	HOURS	SERVICE CHARGE	EXPENSES	TOTAL
TING	8.00	480.00		480.00
TING	1.50	90.00		90.00
TING	3.00	180.00		180.00
TING	6.00	360.00		360.00
TING	6.00	360.00		360.00
TING	6.00	282.00		282.00
TING	3.00	78.00		78.00
TING			31.44	31.44
TING			1.00	1.00
TING	8.00	480.00		480.00
TING			12.00	12.00
TING			152.00	152.00
TING			7.60	7.60
TING	5.00	235.00		235.00
TING			156.00	156.00
TING			14.00	14.00
TING	1.00	47.00		47.00
TING	3.00	180.00		180.00
TING	2.00	94.00		94.00

PAY THIS AMOUNT: $ 3240.04

EST CHARGE OF 1.5% WILL BE ASSESSED FOR DELINQUENT PAYMENT.

RADIATION MANAGEMENT CORPORATION
UNIVERSITY CITY SCIENCE CENTER
3508 MARKET STREET
PHILADELPHIA, PA. 19104
(215) 243-2950

INVOICE TERMS: ----------NET

****

INVOICE NUMBER: C00464

DATE: 12/23/80

P.O. NBR: LTR 92280

FACILITY: RMC STAFF SERVICES

METROPOLITAN ST. LOUIS SEWER DISTRICT
3000 HAMPTON AVE
[redacted] 10 E. Grand Avenue,
[redacted] St. Louis, MO 63147
ATTN: MR. BERNARD RAINS
[redacted]

Attn: Mr. Bernard Rains

SERVICE DATE	EMP		TYPE OF SERVICE		SERVICE CATEGORY
10/28/80	JM	147	SCIENTIST	7 1	PROFESSIONAL CONSULTING
10/30/80	JM	147	SCIENTIST	7 1	PROFESSIONAL CONSULTING
10/31/80	JM	147	SCIENTIST	7 1	PROFESSIONAL CONSULTING
11/ 2/80	SHB	192	TRVL. EXP.:LODG.	7 1	PROFESSIONAL CONSULTING
11/ 3/80	LFB	62	SR. SCIENTIST	7 1	PROFESSIONAL CONSULTING
11/ 3/80	JM	147	SR. TECHNICIAN	7 1	PROFESSIONAL CONSULTING
11/ 3/80	SHB	192	TRVL. EXP.:LODG.	7 1	PROFESSIONAL CONSULTING
11/ 4/80	JM	147	SR. TECHNICIAN	7 1	PROFESSIONAL CONSULTING
11/ 7/80	LFB	62	SR. SCIENTIST	7 1	PROFESSIONAL CONSULTING

BEGINNING 1/ 7/81 AND EACH FIFTEEN DAYS THEREAFTER AN INTEREST CHARGE OF

MSD 000854

-------NET/15

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ERVICES

HOURS	SERVICE CHARGE	EXPENSES	TOTAL
2.00	74.00		74.00
3.00	111.00		111.00
3.00	111.00		111.00
		374.62	374.62
1.00	47.00		47.00
5.00	105.00		105.00
		169.39	169.39
2.00	42.00		42.00
1.00	47.00		47.00

PAY THIS AMOUNT: $ 1081.01

ARGE OF 1.5% WILL BE ASSESSED FOR DELINQUENT PAYMENT.

RADIATION MANAGEMENT CORPORATION
UNIVERSITY CITY SCIENCE CENTER
3508 MARKET ST.
PHILADELPHIA, PA. 19104
(215) 243-2950

DATE : 11/30/80

INVOICE #: L02043

METROPOLITAN ST. LOUIS SEWER DISTRICT
2000 HAMPTON AVE.
ST. LOUIS, MO 63139
ATTN: MR. BERNARD RAINS

CHARGES FOR ANALYTICAL SERVICES FOR
THE PERIOD 11/16/80 TO 11/30/80 PER
ATTACHED PAGES 1 THRU 1

TOTAL CHARGE

$ 550.00

PLEASE PAY
THIS AMOUNT

TERMS: NET 15 DAYS
SERVICE CHARGE:
1 1/2% PER MONTH
FOR EACH MONTH
OUTSTANDING BEYOND
15 DAY NET PERIOD

ALL REMITTANCES SHOULD
BE FORWARDED TO:
RADIATION MANAGEMENT CORP.
P.O. BOX 8068-5107
PHILA., PA 19177

CUSTOMER-ID	RMC-ID	STOPDATE	DATE OF ANALYSIS	DATE OF REPORT	UNIT PRICE
GELI GAMMA SPECTROSCOPY OF DRIED SOLID SAMPLES					
SE/SDG/BPSTP GRIT	38692G85	7/31/80	10/17/80	11/18/80	50.00
SE/SLD/BISSELLI PT.	40189G85	8/31/80	11/19/80	11/24/80	50.00
	40189G85 EXTRA CHARGE				+50.00
SE/SLD/BISSELLI PT.	40190G85	9/30/80	11/19/80	11/24/80	50.00
	40190G85 EXTRA CHARGE				+50.00
SE/SLD/BISSELLI PT.	40191G85	10/31/80	11/19/80	11/24/80	50.00
	40191G85 EXTRA CHARGE				+50.00
SE/SLD/LEMAY STP.	40192G85	8/19/80	11/19/80	11/24/80	50.00
	40192G85 EXTRA CHARGE				+50.00
SE/SLD/ALPHA CEMEN	40193G85	11/ 4/80	11/19/80	11/24/80	50.00
	40193G85 EXTRA CHARGE				+50.00

LABORATORY INVOICE

RADIATION MANAGEMENT CORPORATION
UNIVERSITY CITY SCIENCE CENTER
3508 MARKET ST.
PHILADELPHIA, PA. 19104
(215) 243-2950

DATE : 11/30/80

INVOICE #: L02000

METROPOLITAN ST. LOUIS SEWER DISTRICT
2000 HAMPTON AVE.
ST. LOUIS, MO 63139
ATTN: MR. BERNARD RAINS

CHARGES FOR ANALYTICAL SERVICES FOR
THE PERIOD 11/15/80 TO 11/30/80 PER
ATTACHED PAGES 1 THRU 1

TOTAL CHARGE

$ 850.00

PLEASE PAY
THIS AMOUNT

TERMS: NET 15 DAYS
SERVICE CHARGE:
1 1/2% PER MONTH
FOR EACH MONTH
OUTSTANDING BEYOND
15 DAY NET PERIOD

ALL REMITTANCES SHOULD
BE FORWARDED TO:
RADIATION MANAGEMENT CORP.
P.O. BOX 8068-5107
PHILA., PA 19177

GELI GAMMA SPECTROSCOPY OF DRIED SOLID SAMPLES

CUSTOMER-ID	RAC-ID	STOPDATE	DATE OF ANALYSIS	DATE OF REPORT	UNIT PRICE
SE/SDG/BP INTERCEP	38673G85	9/26/80	10/15/80	11/ 4/80	50.00
SE/SDG/BP INTERCEP	38674G85	9/26/80	10/16/80	11/ 4/80	50.00
SE/SDG/ASH BASIN	38677G85	12/19/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38678G85	12/20/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38679G85	12/21/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38680G85	12/24/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38681G85	12/26/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38682G85	12/27/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38683G85	12/28/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38684G85	12/31/79	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38685G85	1/ 2/80	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38686G85	1/ 3/80	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38687G85	1/ 4/80	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38688G85	1/ 7/80	10/16/80	11/13/80	50.00
SE/SDG/ASH BASIN	38689G85	1/ 8/80	10/17/80	11/13/80	50.00
SE/SDG/ASH BASIN	38690G85	1/ 9/80	10/17/80	11/13/80	50.00
SE/SDG/BPSTP ASH	38691G85	7/31/80	10/17/80	11/13/80	50.00

UNIVERSITY CITY SCIENCE CENTER
3508 MARKET STREET
PHILADELPHIA, PA. 19104
(215) 243-2950

INVOICE

TERMS: ----------

****

INVOICE NUMBER: C00450

DATE: 11/18/80

P.O. NBR: LTR 92280

FACILITY: RMC STAFF SERVICES

METROPOLITAN ST. LOUIS SEWER DISTRICT
2000 HAMPTON AVE.
ST. LOUIS, MO 63139
ATTN: MR. BERNARD RAINS

SERVICE DATE	EMP		TYPE OF SERVICE		SERVICE CATEGORY
9/11/80	FLB	59	TRVL. EXP.:LODG.	7 1	PROFESSIONAL CONSULTING
9/12/80	FLB	59	TRVL. EXP.:LODG.	7 1	PROFESSIONAL CONSULTING
9/12/80	FLB	59	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
9/12/80	LFB	62	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
9/12/80	LFB	62	TRVL. EXP.:TRAN.	7 1	PROFESSIONAL CONSULTING
9/22/80	FLB	59	SR. PROF CONSULT	1713	PROFESSIONAL CONSULTING

BEGINNING 12/ 3/80 AND EACH FIFTEEN DAYS THEREAFTER AN INTEREST CHARGE OF

HOURS	SERVICE CHARGE	EXPENSES	TOTAL
		261.00	261.00
		67.21	67.21
		64.87	64.87
		13.63	13.63
		152.00	152.00
2.00	170.00		170.00

PAY THIS AMOUNT: $ 728.71

5% WILL BE ASSESSED FOR DELINQUENT PAYMENT.

METROPOLITAN ST. LOUIS SEWER DISTRICT

2000 HAMPTON AVE. ST. LOUIS, MO. 63139 Radiation Management 768-6226

DEPARTMENT	DIVISION	DATE	DEL. DATE	F.O.B.	BID NO.	REQUISITION NO.	P.O. NO.
WASTEWATER	IND. WASTE	2/27/81	COMPLETED	DEST.		734	P- 01298

P.O. NUMBER MUST APPEAR ON INVOICE CONFIRMATION INVOICE MUST BE IN TRIPLICATE

RESERVED FOR PURCHASING MANAGER

CODE

NAME RADIATION MANAGEMENT

STREET

CITY STATE ZIP

BILL TO: 10 EAST GRAND AVENUE
ST. LOUIS, MISSOURI 63147

SHIP TO: SAME

RESERVED FOR PURCHASING MANAGI

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
1			RMC Staff Service, P.O. #92280		$3,240.04
2			" " P.O. #L022216		$ 260.00

TOTAL $3,240.04

NOT VALID UNLESS SIGNED BY DIRECTOR - DEPT. OF FINANCE

FUND	DEPARTMENT	RECORDED	PAYMENT AUTHORIZATION	P.O. NO.
101	70		1	P- 01298

PO	P.O. NUMBER	ORGN.	SUB. ORGN.	ACTV.	OBJ.	SUB. OBJ.	BIS. ACCT.	IND.	ENCUMBRANCE AMT.	PAYMENT AMT.	ID	PD
PO		600	01		431				$3,240.04	$2,500.04		F
PO												
PO												
PO												
PO												

TOTAL $2,500.04

5 - REQUISITIONEE

MSD 000862

2000 HAMPTON ST. LOUIS, MO. 63139 Relocation Management 768-6200

DEPARTMENT	DIVISION	DATE	DEP. DATE	ACCT.	P.O. NO.	P.A. NO.
						R- 04415

P.A. NUMBER MUST APPEAR ON INVOICE INVOICE MUST BE IN TRIPLICATE

☐ RESTRICTED TO 100.00 PURCHASES ☐ RELEASE NO. FOR BLANKET ORDERS UNDER 500.00 * ☐ RELEASE AGAINST BPO OVER 500.00

BILL TO:

CODE

NAME

STREET

CITY STATE ZIP

SHIP TO:

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT

REQUESTED BY

APPROVED BY

RECEIVED BY

* NOT VALID UNLESS SIGNED BY DIRECTOR — DEPT. OF FINANCE

FUND	DEPARTMENT	RECORDED	PAYMENT AUTHORIZATION	P.A. NUMBER
101				R- 04415

PO	PO NUMBER	ORGN.	SUB. ORGN.	ACTV.	OBJ.	SUB. OBJ.	BIS. ACCT.	IND.	ENCUMBRANCE AMT.	PAYMENT AMOUNT	ID	PR.
PO												
PO												
PO												
PO												
PO												
PO												
PO												
PO												
PO												
PO												

TOTAL

5 - REQUISITIONEE

PAST DUE

rmc

radiation management corporation

UNIVERSITY CITY SCIENCE CENTER

3508 MARKET STREET
PHILADELPHIA, PA 19104
(215) 243-2950

January 8, 1981

Metropolitan St. Louis Sewer
2000 Hampton Avenue
St. Louis, Mo. 63139
Attn: Accounts Payable

Dear Client:

A review of your account shows the following invoices that are past due. Your immediate attention and remittance is requested. If there is any reason(s) your payment has been delayed, please contact the Accounting Department.

INVOICE #	DATE	AMOUNT
C00450	10/30/80	$728.71
2000	11/30/80	850.00
C00464	11/30/80	1081.01

Accounts Receivable
ACCOUNTING DEPARTMENT

Send remittance to: RADIATION MANAGEMENT CORPORATION
P.O.Box 8068-5107
Philadelphia, PA 19177

2000 HAMPTON AVE. ST. LOUIS, MO. 63139 768-6226

DEPARTMENT	DIVISION	DATE	DEL. DATE	F.O.B.	BID NO.	REQUISITION NO.	P.O. NO.
WASTEWATER	IND. WASTE	2/13/81	COMPLETE	DEST.		729	P- 01231

P.O. NUMBER MUST APPEAR ON INVOICE CONFIRMATION INVOICE MUST BE IN TRIPLICATE

RESERVED FOR PURCHASING MANAGER

File

CODE

NAME UNDER RADIATION MANAGEMENT CORPORATION

STREET

CITY STATE ZIP

BILL TO: 10 EAST GRAND AVENUE

ST. LOUIS, MISSOURI 63147

SHIP TO: SAME

RESERVED FOR PURCHASING MANAGE

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
1			Invoice #C00464, RMC Staff Services		1,081.01
			(see attached)		
				TOTAL	$1,081.01

NOT VALID UNLESS SIGNED BY DIRECTOR - DEPT. OF FINANCE

FUND	DEPARTMENT	RECORDED	PAYMENT AUTHORIZATION	P.O. NO.
101	70			P- 01231

PO	P.O. NUMBER	ORGN.	SUB. ORGN.	ACTV.	OBJ.	SUB. OBJ.	BIS. ACCT.	IND.	ENCUMBRANCE AMT.	PAYMENT AMT.	ID	PF
PO		600	01		431				$1,081.01	# 953.01		
PO												
PO												
PO												
PO												

TOTAL # 953.01

5 - REQUISITIONEE

MSD 000865

METROPOLITAN ST. LOUIS SEWER DISTRICT

2000 HAMPTON AVE. ST. LOUIS, MO. 63139 768-6266 768-6225

DEPARTMENT	DIVISION	DATE	DEL. DATE	F.O.B.	BID NO.	REQUISITION NO.	P.O. NO.
WASTEWATER	IND. WASTE	1/12/81	COMPLETE	DEST.		720	P- 01042

P.O. NUMBER MUST APPEAR ON INVOICE CONFIRMATION INVOICE MUST BE IN TRIPLICATE

RESERVED FOR PURCHASING MANAGER

CODE

NAME RADIATION MANAGEMENT CORP.
UNIVERSITY CITY SCIENCE CENTER

STREET

CITY STATE ZIP

BILL TO: 10 EAST GRAND AVENUE
ST. LOUIS, MISSOURI 63147

SHIP TO: SAME

RESERVED FOR PURCHASING MANAGER

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
1			9/12/80 - travel expenses for Frazier Bronsom and Lee Booth (RMC Initial Consultation)		728.71
2			Analyses of special solid samples from August thru November for Bissell Point and Lemay and Alpha Cement samples		550.00
3			Analyses of special solid samples from interceptor sewer, Bissell Point ash heaps and Bissell Point Ash on 9/26/80, Dec. 1979 and January 1980		850.00

TOTAL $2,128.71

NOT VALID UNLESS SIGNED BY DIRECTOR - DEPT. OF FINANCE

R. Wieting

FUND	DEPARTMENT	RECORDED	PAYMENT AUTHORIZATION	P.O. NO.
101	70	JM		P- 01042

PO	P.O. NUMBER	ORGN.	SUB. ORGN.	ACTV.	OBJ.	SUB. OBJ.	BIS. ACCT.	IND.	ENCUMBRANCE AMT.	PAYMENT AMT.	ID	PC
PO		0600	01		400				$2,128.71	4/21/81		F
PO					431							
PO												
PO												
PO												

TOTAL $2,128.71

5 - REQUISITIONEE

4/15/81

MSD 000866

MSD-7.2

MEMORANDUM

METROPOLITAN ST. LOUIS SEWER DISTRICT

_______________ 19 _______

PD ⓪1042 2,128.71

Total 6,621.76
3,742.00
$10,363.76

By: